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APPLIED HYDRAULICS

DECEMBER 1955

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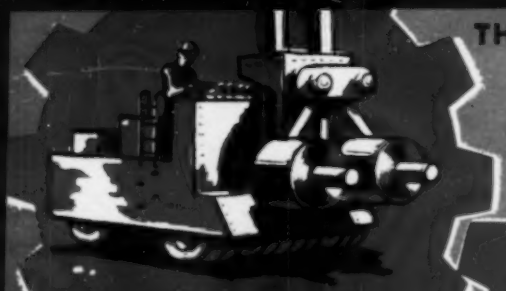
THE MAGAZINE OF FLUID POWER



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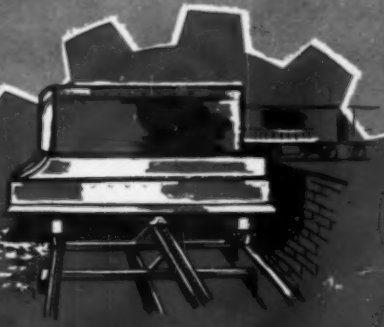

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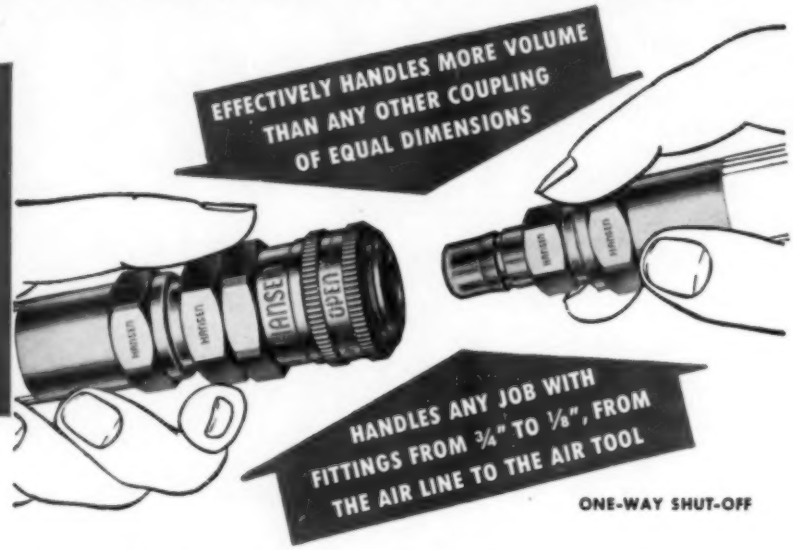
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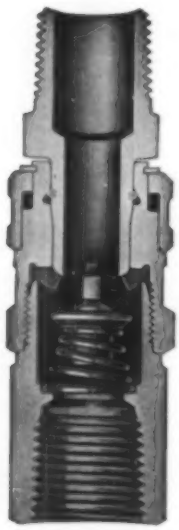

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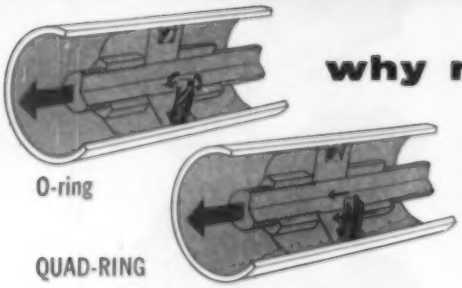

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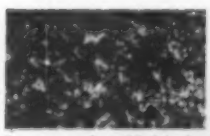
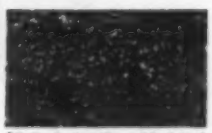
why minnesota rubber seals last longer


Compression Molded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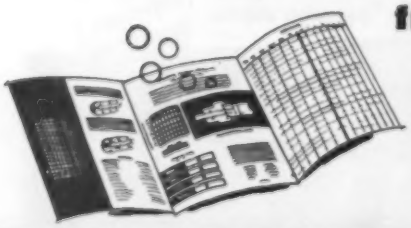

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THE MAGAZINE OF FLUID POWER

DECEMBER 1955
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Bulletin No. 300 gives you full information on complete "Duloc" Assemblies.

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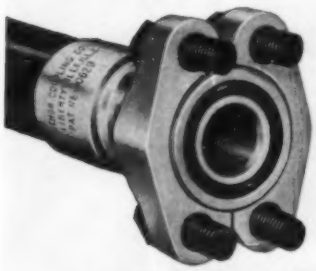
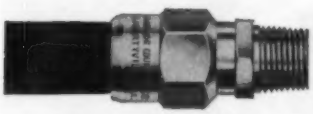


Anchor "Flanco" 4-bolt, Split-Flange Couplings.



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Close-up of one of the 18" piston rods sealed by U. S. Matchless V-Packing.

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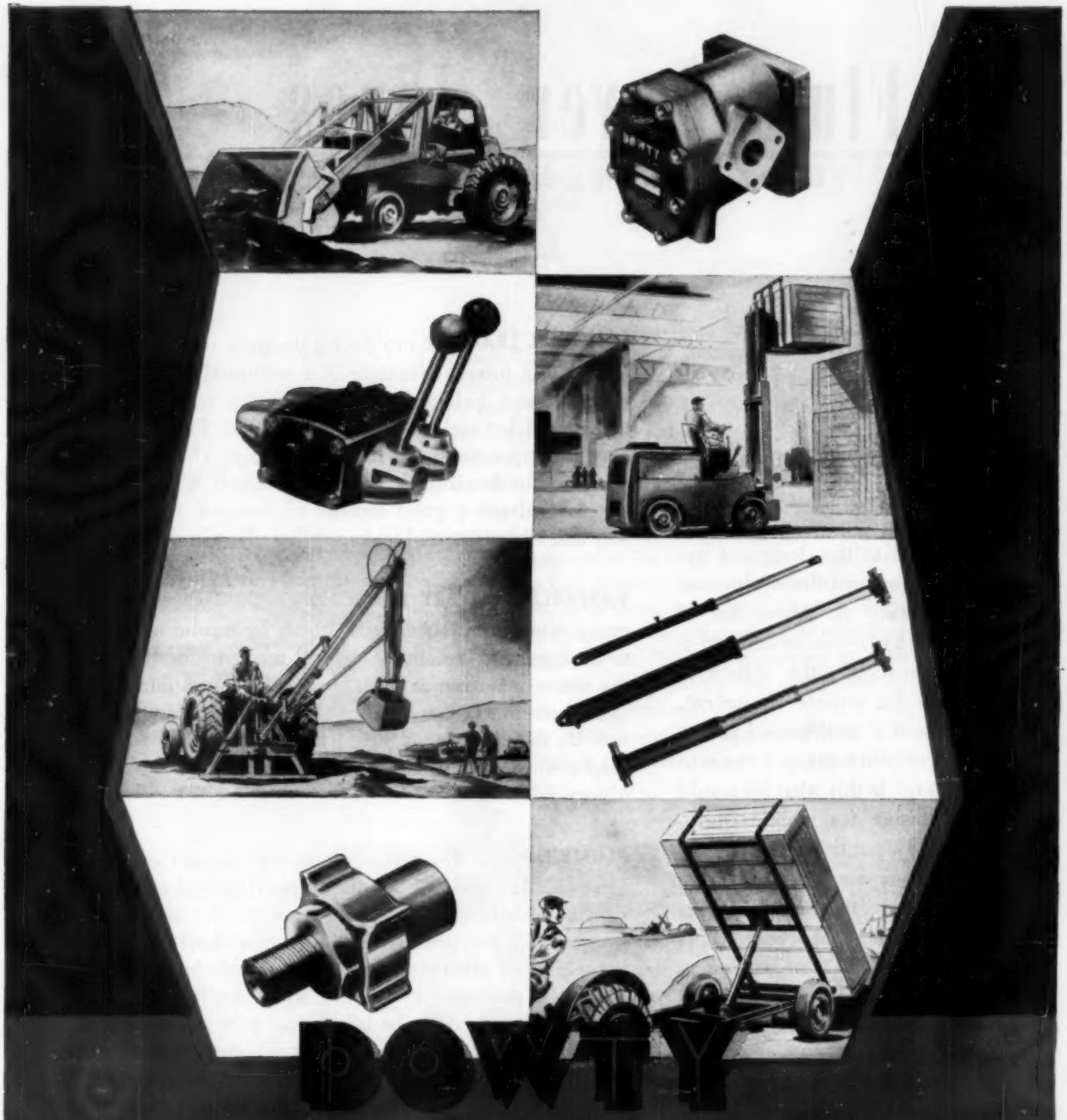

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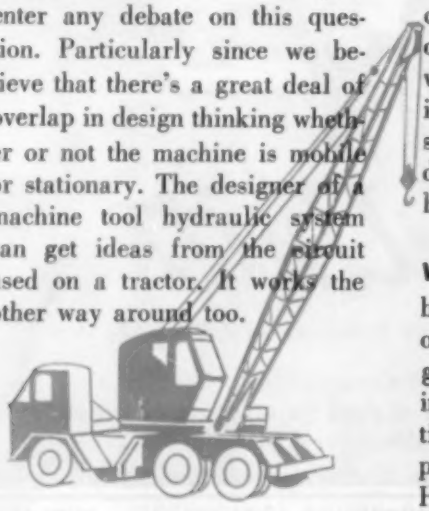
Fluid Power Lines

about Applied Hydraulics

WHAT'S MOBILE EQUIPMENT? "This month's cover tells you that most of the articles in this issue are related to the design of hydraulics for mobile equipment. We probably all agree that if there's a hydraulic system on a moving machine, the system is designed for mobile equipment. How about a stationary hydraulic system which drives a chain to move cars? Is this what we would call: "design for mobile equipment"? By publishing an article in this issue about such a drive you can guess that our answer to the last question is "yes". However, we wouldn't be willing to enter any debate on this question. Particularly since we believe that there's a great deal of overlap in design thinking whether or not the machine is mobile or stationary. The designer of a machine tool hydraulic system can get ideas from the circuit used on a tractor. It works the other way around too.



INTERNAL LEAKAGE . . . To the designer of a gear pump, minimizing internal leakage is a continual challenge. To the user, this hidden leakage represents power which is being paid for and not available for use. Pump performance largely depends on internal leakage. This problem is discussed in detail in this issue by Russell W. Henke who has carried out a great amount of research to determine why and where internal leakage takes place in a gear pump.

VARIABLE DELIVERY PUMP CONTROL . . . Among the many interesting design jobs in the hydraulic field is the development of automatic control mechanisms for changing the output from a variable displacement pump. Control of motion is the basis of the article by Mr. R. Rowson. He details a servo type actuator which changes pump displacement in response to the position of the fluid motor driven work load.

PLUMBING . . . The term "plumbing" doesn't exactly inspire us. Maybe this is because of previous sad experiences with household chores on the same subject and with the gentlemen in that profession. But then, without plumbing—household or otherwise—where would we be? So despite our small prejudice toward the word, we find it a handy catch-all term to describe hose, pipe, tube and fittings and we're constantly on the lookout for design, application and installation ideas. One piece of circuit plumbing is the subject of an article this month. How do you carry a hydraulic line from a rotating member to a stationary member? The answer to this is in the story on page 68.

VALVE DESIGN . . . Most directional control valves on mobile equipment are manually operated. And since the operator usually has to control several cylinders, it's a good idea to group all the handles for the valves directly in front of him. Because most mobile machines have multiple operations there is a large enough market to warrant production of two, three, and four plunger valves. Ed Hrdlicka's article on page 60 takes you further into this subject of control valves.

Precision "O" Rings pay off in Payloaders

With over 30 years experience in the field, The Frank G. Hough Co., Libertyville, Ill., has engineered their line of Payloader tractor shovels for efficient bulk handling under many conditions of service. The reliability of Payloader is partially due to fine engineering of the torque converter drive, and the sealed and pressurized hydraulic system which actuates the boom arms and bucket.

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High quality, compression molded *Precision* "O" Rings are meeting the precision requirements of an increasing number of manufacturers. Their use is growing for both static and dynamic seals in fluid power and pneumatic service involving either vapors or liquids.

Step up your product performance by specifying "O" Rings by *Precision*, the world's largest exclusive producer.

(This case history is just one of hundreds that provide "Proof of Performance" of Precision "O" Rings.)

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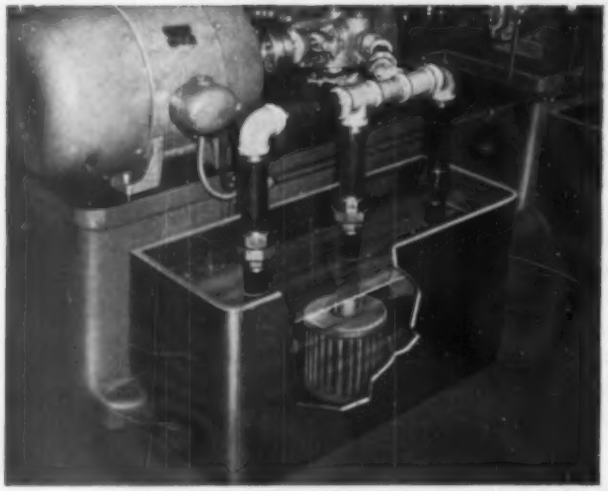

1. SAVE WEAR ON COSTLY EQUIPMENT
2. SAVE SPOILAGE AND REJECTS AT POINT OF USE
3. SAVE MAN HOURS WASTED IN EQUIPMENT REPAIRS AND MAINTENANCE

Illustration shows method of securing desired capacity in relatively long and narrow tank by means of multiple hook-up.

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Tank Capacity: 200 Gallons
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Delivery 19.6 GPM @ 1250 PSI,
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Application: Paper Making Machinery

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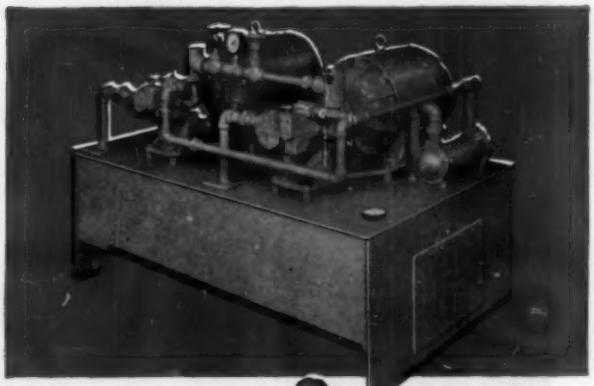
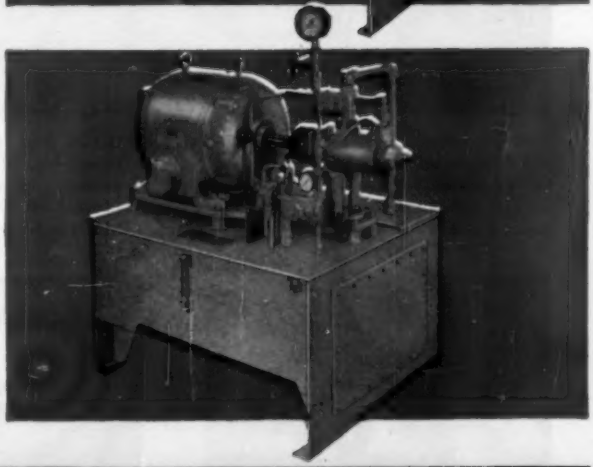
POWER UNIT MODEL SP-2954

Tank Capacity: 100 Gallons
Motor: 7½ HP—1800 RPM—TEFC
Delivery: 16 GPM @ 600 PSI
Application: Rolling Mill Machinery



TYPICAL CONTROL PANEL

Hydraulic control console for section of paper making machines. Control panel permits accurate pressure control of rolls.



POWER UNIT MODEL SP-1254

Tank Capacity: 50 Gallons
Motor: 15 HP—1800 RPM
Delivery: 4 GPM @ 5000 PSI
Application: Missile Test Unit

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BRIEFS about fluid power

. . . AT THE 1955 NCIH

Irving B. Hexter, president, Industrial Publishing Group, presented the prizes to the top winners of the 1955 APPLIED HYDRAULICS Prize Paper Contest at the Thursday luncheon of the 11th Annual National Conference on Industrial Hydraulics. Hexter thanked the judges of the third annual contest, in giving their time and generous support by evaluating the many papers received from people in the fluid power industry in the United States and abroad. Judges of this year's contest were William E. Adamek, senior production engineer, Fisher Body Division, General Motors Corporation; David Hutchinson, Sundstrand Machine Tool Co.; and Joseph F. Ziskal, chief engineer, Hydraulic Division, International Harvester Co. The prize winning papers presented outstanding examples of design, application and operating techniques of fluid power.

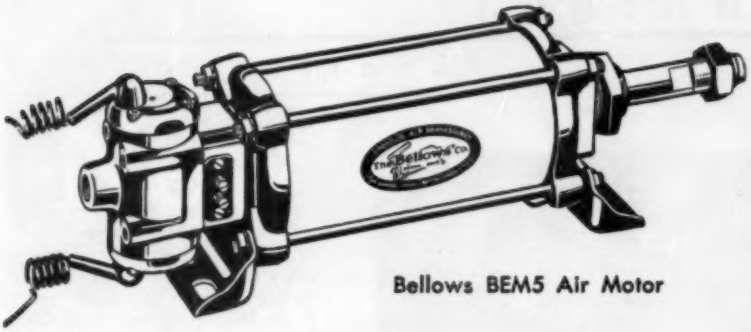
Award winners of the 1955 APPLIED HYDRAULICS Prize Paper Contest, left to right: Raymond L. Ober, Manning, Maxwell & Moore, Inc.; Richard A. Fischer, The United States Bedding Co.; Irving B. Hexter, president, Industrial Publishing Group; John E. Minty, Manning Maxwell & Moore, Inc.; Joseph H. Cohen, The Cross Company; and Edward L. Bronstien, Jr., The United States Bedding Co.

First prize, $500 was awarded to Joseph H. Cohen, design engineer, The Cross Company, for his paper "Design of a Hydraulic Power Unit for a Multi-Station Transfer Machine". A practical approach to layout and selection of reservoir, pumps, valves and piping to meet space, cost, safety and maintenance requirements. Edward L. Bronstien, Jr. and Richard A. Fisher, engineering department, The United States Bedding Company, were awarded second prize, $300 for their paper "A New Development—Fluid Power in the Home". A truly new application for oil power, opening and closing a convertible bed davenport. The third prize, $200 was shared by John E. Minty, director of engineering and Raymond L. Ober, project engineer, Manning, Maxwell & Moore, Inc., for their

Continued on page 14

E. B. Pool and David Victor, Edwards Valve Company, were among the first to register for this year's conference, held at the La Salle Hotel in Chicago.

J. T. Greenlee, vice president, Imperial Brass Mfg. Co. welcomes delegates at opening session. R. G. Owens, dean of engineering, is on the right.



Bellows BEM5 Air Motor

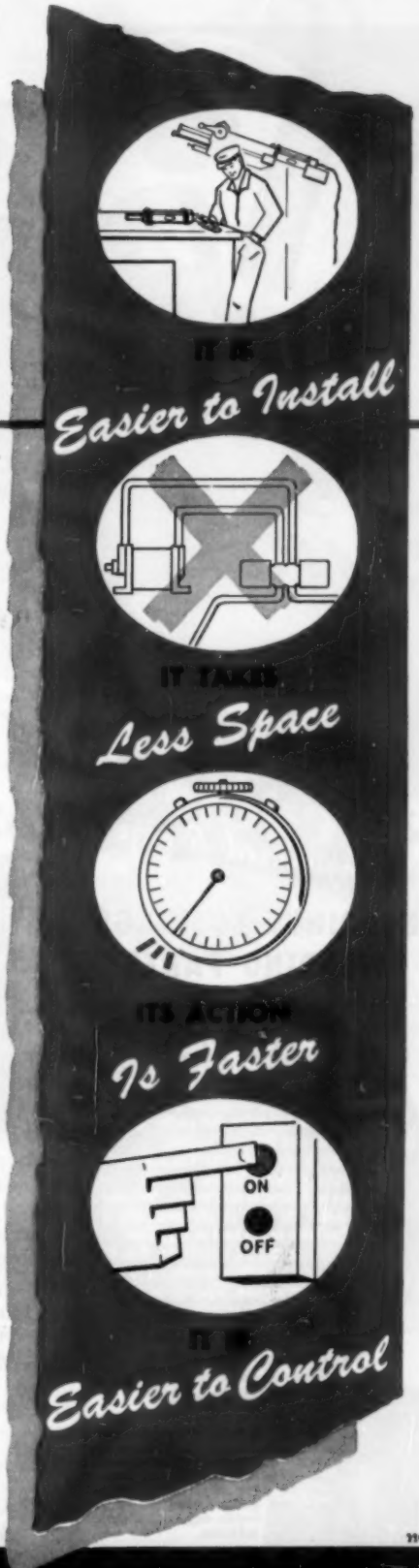
WHY YOU SHOULD BUY the AIR CYLINDER with the Built-in Valve

When it comes to down-right value, the Bellows Air Motor (the air cylinder with the built-in valve) tops them all for both standard air cylinder operations or as a component in new design applications. Not only are you buying a precision-built power unit — but you are buying a complete power unit. No extra valves to buy —dual speed control valves as well as directional valve are integral with the cylinder; no cumbersome, complex piping to install—a single, flexible air hose is all the hook-up you'll need.

You can have your choice of built-in directional valves: 110 volt or 8 volt electrical control, standard or explosion-proof, manual control, or air poppet valve control. Five bore sizes: 1¼", 1¾", 2½", 3⅝", and 4½". Any stroke length.

WRITE FOR THESE TWO BULLETINS:

Contain full data and specifications on Bellows Air Motors. Free. Address Dept. AH-1255. The Bellows Co. Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd. Toronto.



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there really is a
World of Difference
in Bearings

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Engineered Bronze

BEARINGS-BUSHINGS
WEARING PARTS

Standard and special formulas developed for specific or unusual conditions. Assure the best combination of physical properties, strength in tension and compression, hardness and ability to sustain both static and dynamic loading. Protect moving parts from injury, scoring, and seizing due to temporary interruption or failure of lubrication. Will not powder under the most severe conditions of service. Available rough cast or machined to precisely controlled tolerances. Can be machined at surface speeds up to 875 lineal feet per minute. Castings to your patterns, any size, shape or section, delivered as scheduled and specified. Pattern making, designing and machining when required.

Write for free literature and service data sheets. Send blueprints, conditions of operation and other data for recommendations and quotations. You are invited to discuss your bearing problems with our metallurgists, engineers and laboratory technicians.

THE
American Crucible
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"Bearing Specialists Since 1919"
1303 Oberlin Avenue Lorain, Ohio, U.S.A.

BRIEFS continued

R. O. Isenbarger, Chicago Rawhide Mfg. Co.,—director of next year's conference—Claude D. Young, Foxboro Company and R. Q. Sharpe, Socony Mobil Oil Co. are getting ready to attend the first technical session.

Jack L. Modrich and Mark Tull of Hydro-Line Manufacturing discuss their display of cylinders.

Relaxing between sessions, from left to right: W. M. Condon, Jr., U. S. Rubber Co.; Orlo Portman, U. S. Rubber Co.; R. W. Phillips, Flex-O-Tube Division; and J. F. Comstock, U. S. Rubber Co.

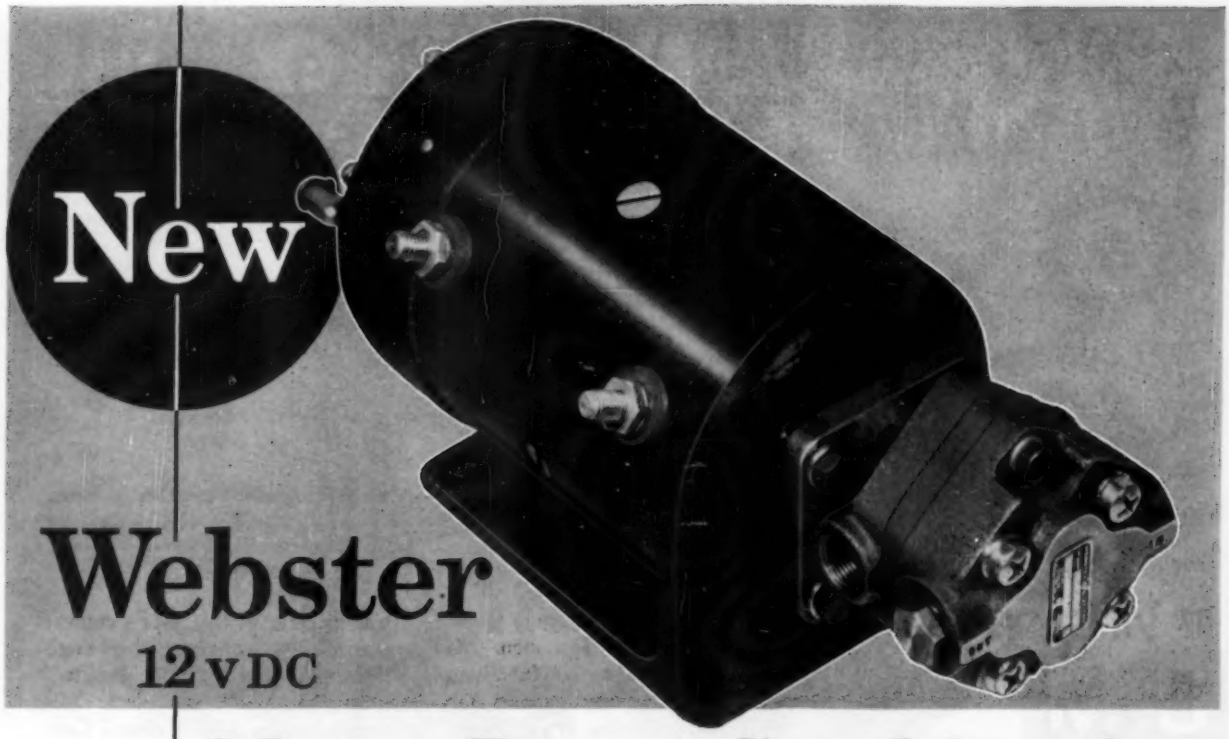
W. H. McGill, Blackhawk Mfg. Co., and Alfred Darcey, United Shoe Machinery Corporation, exchange opinions in front of Blackhawk's exhibit.

paper "Hydraulic Overhead Traveling Crane". It's the story of the first practical design of an overhead crane which uses fluid power for all three crane motions, the bridge, the hoist and the trolley.

These three prize winning papers appeared in the October issue of APPLIED HYDRAULICS and during the coming months all papers, which won cash awards and received honorable mention, will be published.

This year's meetings—reported by our editors on page 87—were

Continued on page 16



Motor Pump Combination

FOR MOBILE APPLICATIONS

for All Battery-operated Vehicles, Lift Trucks, Snow Plows, Tail Gate Lifts, Graders

• Here's WEBSTER's brand new motor-pump combination for all 12 volt battery-operated applications. It is furnished in a range of capacities up to 2½ gpm at 1000 PSI, with permissible pressures up to 3000 PSI.

This new unit carries a very reasonable price tag. And it incorporates the quality construction features and advanced engineering you've learned to expect from WEBSTER. For example:

Compact, Easy Mounting · The entire combination measures only 12⅜" in length. The clean, compact design includes a 4-bolt foot mounting integral with the motor for ease of installation in crowded locations.

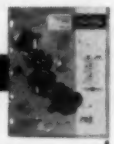
Direct Coupled · Direct coupling eliminates alignment problems between pump and motor, does away with any need for external flexible couplings. The hydraulic power source can be readily installed near the power requirements, substantially shortening the length of hydraulic circuits—thus minimizing danger of leaks and reducing maintenance.

Adaptable · Pumps with greater or smaller capacities can be substituted without changing the mounting. Parts are standardized and interchangeable for greatest flexibility. Built-in relief valves and check valves can be provided if desired.

Nylon Valves—a Webster Exclusive · Nylon check and relief valves, exclusive with WEBSTER, for leakproof operation and longer life. Nylon plungers provide tight seal even if minute particles of foreign matter are caught between plunger and seat.

Special Motor Construction · Specially constructed heavy duty DC series motor gives high starting torque—can be supplied with stationary or removable brushes.

Write Today



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☐ Please send us performance data on new 12 v DC Motor Pump Combination

☐ Please send catalog on complete WEBSTER line

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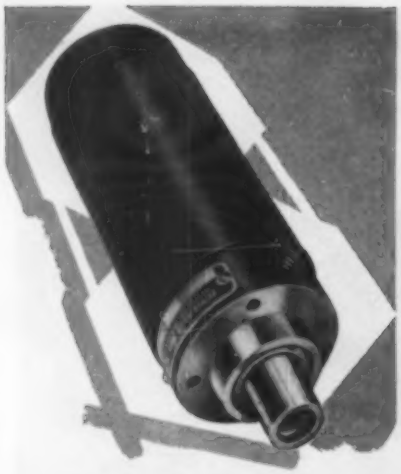
OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

RACINE WISCONSIN

MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS FROM 1/5 TO 30 GPM CAPACITY



the POWER you need in 1/3 less space...

O-M

CYLINDERS
TIE ROD-LESS

- *air and hydraulic*
- *meet JIC standards*

O-M's special interlocking mechanism strips unnecessary bulk, does away with tie rods and out-sized end caps . . . saves up to ⅓ the installation space required by conventional-type cylinders of the same bore.

This internal locking feature means less maintenance, too. O-M cylinders are easier to clean, inspect, remove, disassemble and service, with no alignment problems in re-assembly.

Available in complete range of sizes (1½ to 8" bores), with standard, 2 to 1 or oversize rods. All steel construction with bearing bronze. Completely interchangeable parts. Immediate delivery on many sizes.

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MAIL COUPON NOW!

ORTMAN-MILLER MACHINE COMPANY
1143rd Street, Hammond, Indiana
☐ Have representative call
☐ Send latest catalog

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Company_____
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BRIEFS continued

Jack McGuire and Ed Braun, Waterman Engineering Corp. arrange the products manufactured by their company.

Carl W. Lindahl, Denison Engineering Co., is shown a filter by William Thomas, Marvel Engineering Co.

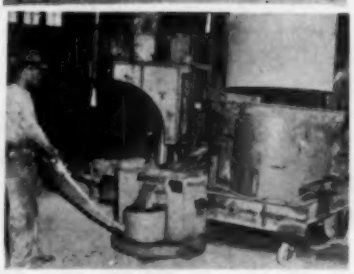
attended by approximately 1000 design and production men. Attendance at the social functions provided a meeting ground for the largest gathering of people engaged in the ever growing fluid power industry.

J. T. Greenlee, vice president, Imperial Brass Manufacturing Co., was director of this year's conference. R. O. Isenbarger, chief engineer, Chicago Rawhide Manufacturing Company, was elected director for the 12th National Conference on Industrial Hydraulics, to be held in 1956. Conference secretary for 1956 is Raymond D. Meade. ▼▼▼

Shop-Built Handling Cart Is Fluid Powered

It used to take six men to load and move, with manually powered hand jacks, moulding jackets containing fresh pipe from the production area to kilns for drying.

Faulkner Concrete Pipe Company solved this handling problem by designing and building a four wheeled U-shaped cart. A conventional floor type automobile jack was installed on each arm to lift the jackets. Power for travel and lifting is supplied from a drive unit of a Clark Powrworker hand truck, complete with the standard hydraulic system. An auxiliary hydraulic tank was installed to compensate for the large cylinders on the jacks and the increased lifting height necessary. Feed lines lead from the control valve of the drive unit to the jack cylinders and a globe valve is cut into each line so that the jacks can be raised independently for leveling a load. When valves are



open, the jacks operate simultaneously.

Use of this new cart has provided faster and safer movement and has saved labor of four men. ▼▼▼

Continued on page 18

RACINE *Variable Volume* PUMPS

"The heart of any Hydraulic Circuit"

MODEL F
Variable Volume Pump
12 - 30 G.P.M.
Pressures to 1000 p.s.i.

MODEL K
Variable Volume Pump
70 G.P.M.
Pressures to 1000 p.s.i.

MODEL Q
Variable Volume Pump
5 G.P.M.
Pressures to 1000 p.s.i.

USE RACINE PUMPS, VALVES, PRESSURE BOOSTERS AND RESERVOIR UNITS

"They Work Better Together"

SALES AND SERVICE REPRESENTATIVES IN ALL PRINCIPAL CITIES

Racine Variable Volume Pumps simplify the circuit. They reduce heat losses and save horsepower. Relief and by-pass valves with extra piping are unnecessary. Your initial circuit costs are usually lower. Write for complete catalog and name of your nearest Racine Field Office. Complete engineering service available . . . Address: **RACINE HYDRAULICS & MACHINERY, INC.**, 2074 Albert Street, Racine, Wisconsin, U. S. A.

two famous names join forces . . .

U S G

BELMONT

for greater service to Industry

● The consolidation of product lines and sales service facilities of the United States Gasket Company and The Belmont Packing & Rubber Company creates a new major source for all your gasket, packing and allied product requirements—*plus* the most complete line of TEFLON and KEL-F stock offered to Industry, today.

It brings together the specialized engineering and manufacturing experience, and enlarged, modern production facilities of these two companies to better serve your standard and special needs.

It brings together the nationwide Industrial Distributor organizations of both companies—backed by an enlarged staff of U. S. Gasket-Belmont Packing field representatives—to make these combined lines even more readily available and profitably employed in every industrial community.

UNITED STATES GASKET COMPANY, Camden 1, N. J.

THE BELMONT PACKING & RUBBER COMPANY, Phila. 37, Pa.

U.S. GASKET—BELMONT PACKING PRODUCTS INCLUDE:

PACKINGS: MOLDED RINGS—Teflon, Asbestos Cloth, Duck. SPIRAL OR COIL PACKING—Braided and Twisted Asbestos, Braided Teflon, Extruded Teflon, Asbestos Fabric, Duck and Rubber, Flax and Jute, Metallic and Semi-Metallic. PLASTIC PACKING—Teflon, Shredded Asbestos, Metallic. SHEET PACKING—Asbestos, Fibre, Cork, Rubber, Synthetic Rubbers, Metallic. O-RINGS, BACK-UP RINGS, V-RINGS, CUPS, U-RINGS, FLANGE PACKINGS—Teflon, Leather, Rubber, Rubber-Reinforced. **GASKETS:** Spiralwound, Molded Teflon, Kel-F, Teflon-Jacketed, Metal-Asbestos, Asbestos, All Metal. **TEFLON SPECIALTIES:** Expansion Joints, Flexible Couplings, Adaptors, Reducers, Rotating Mechanical Seals. **TEFLON & KEL-F STOCK:** sheets, tape, rods, tubing, bars, cylinders, fabricated parts.

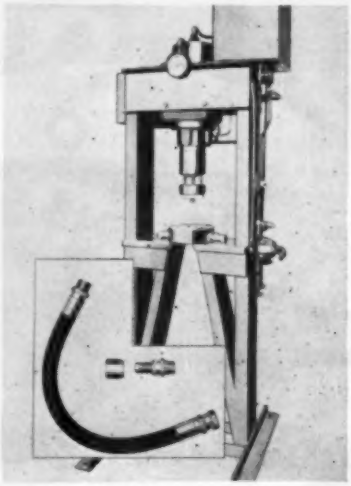
U. S. GASKET • BELMONT PACKING

BRIEFS continued

Manufacturer Expedites Hose Assembly Service

Immediate delivery service on swaged hose assemblies is part of a broad sales and merchandising plan by The Weatherhead Company, Fort Wayne Division, to render maximum customer service through its industrial distributors.

A new swaging press developed by the company's engineers will



enable the distributors to make any swaged hose assembly in a few minutes in their own shops. This unit will swage hose sizes from ¼ inch to 2 inches I.D. with male pipe, female swivel or male J.I.C. hose ends.

In cooperation with Weatherhead, hose manufacturers have developed new types of single and double wire braid hoses specifically for the swaging process, which do not require skiving. ▼▼▼

Tau Beta Pi Initiates Members from Fluid Power Industry

Among four Michigan industrialists, selected by the Michigan State University Chapter and the Detroit Alumni Chapter who were initiated into membership in Tau Beta Pi, the National Honorary Society, were Peter F. Hurst, president and general manager, Aeroquip Corporation and William P.

Continued on page 22

Increased *production* without a sacrifice of *precision* is the quest of American industry in this era of automation. Hydraulic cylinders are a vital component in today's automatic machinery. In the Model J Hydraulic Cylinder, Hydro-Line has designed and built an automation cylinder that not only meets all JIC and industry standards but assures uninterrupted performance and safety for both heavy duty work and non-shock service.

Wide Choice of Mountings

"JA" FIXED FOOT MOUNT
"JC" CLEVIS MOUNT
"JR" REAR FLANGE MOUNT
"JX" BASIC CYLINDER
"JB" ROTATABLE FOOT MOUNT
"JF" FRONT FLANGE MOUNT
"JT" TRUNNION MOUNT
SPECIAL MOUNTINGS

● **CYLINDER TUBE**—All-steel, heavy wall, precision bored and honed for the most exacting machine tool applications.

● **PORTS**—Ports are of adequate size and completely unobstructed to allow unrestricted flow.

● **END CAPS**—Unbreakable end caps and mountings machined from solid steel bar stock . . . designed for lifetime, trouble-free service. End caps are retained by heat treated socket head cap screws.

● **REMOVABLE CARTRIDGE GLAND**—This is a heavy duty bronze package-type gland which incorporates self-compensating, non-adjustable, leak-proof lipseal and wiper-seal designed to wipe both ways so as to provide dry rod on outstroke, a dirt free rod on instroke. Cartridge easily removed without disturbing cylinder assembly.

● **CUSHION ADJUSTMENT AND BALL RETAINER**—Interchangeable cushion adjustment and cushion ball check provide simplicity and easy maintenance. (Cushions optional.)

● **PISTON RODS**—Heat treated, stress relieved, ground, polished and hard chrome plated piston rods for maximum rigidity, long life and resistance to scoring.

● **WRENCH FLATS AND ROD ENDS**—Wrench flats and rod ends designed to facilitate replacement of seals and cartridges *without dismantling cylinder.*

● **PISTON RINGS**—Step-cut joint piston rings seal in both directions assure long life and minimum leakage.

Write for Data on the Complete Line of Hydro-Line Air and Hydraulic Cylinders

Hydro-Line CYLINDERS

Gentlemen:
Please send latest literature and specifications on Hydro-Line Hydraulic cylinders.

NAME:_____
TITLE:_____
FIRM:_____
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CITY:_____ STATE:_____

Hydro-Line
MANUFACTURING CO.

5605 PIKE ROAD • ROCKFORD, ILLINOIS

HYDRO-LINE REPRESENTATIVES IN ALL PRINCIPAL CITIES FOR CONSULTATION, RECOMMENDATIONS AND DATA

Guarantee **TOP** Performance and Maximum Life!

Specify THESE TOP QUALITY FEATURES...

(Standard on Miller Cylinders at no extra cost)

Specify CASE HARDENED CHROME PLATED PISTON RODS
On all Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. ***Available from Miller at no extra cost.***

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. ***Available from Miller at no extra cost.***

Specify "TEFLON" WIPERS
On all Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from—100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. ***Available from Miller at no extra cost.***

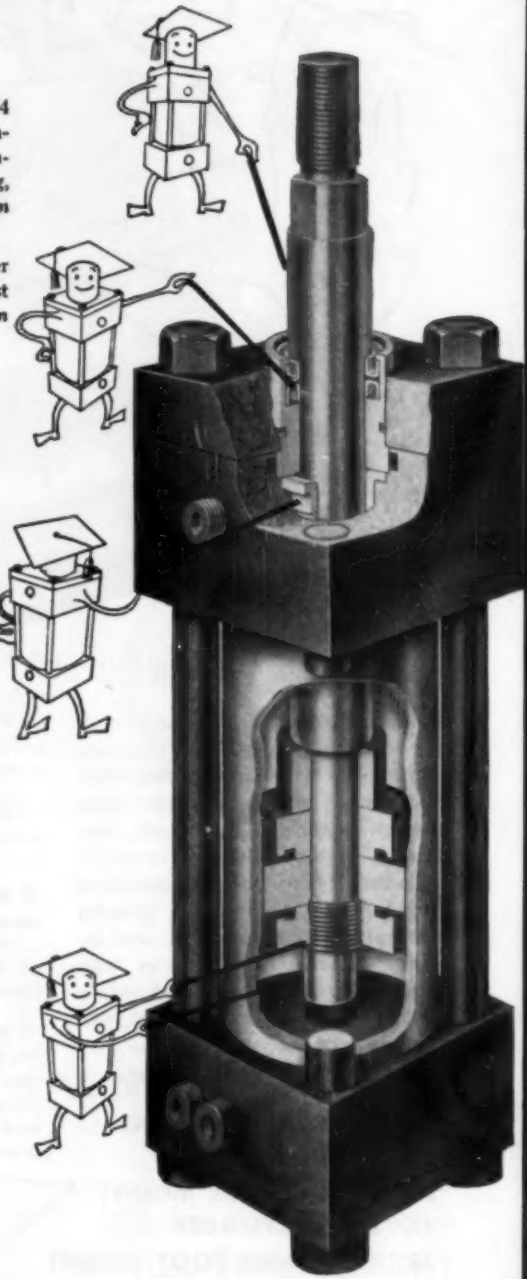
Specify TEFLON HYDRAULIC ROD SEALS
On all Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)

Specify RUST RESISTANT SURFACES
On all Air and Hydraulic Cylinders



You may wish to route this entire page to the proper department in your company, by using this handy form. Additional copies on request. →

To (Dept.)_____
"On all our future cylinder requirements, please specify the above quality features."

Signed_____

Title_____

EFFECTIVE DATES

These new Miller features will be provided at no extra cost after January 1, 1956—and at Miller's option prior to that date.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • TOLEDO • CINCINNATI • COLUMBUS
PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY
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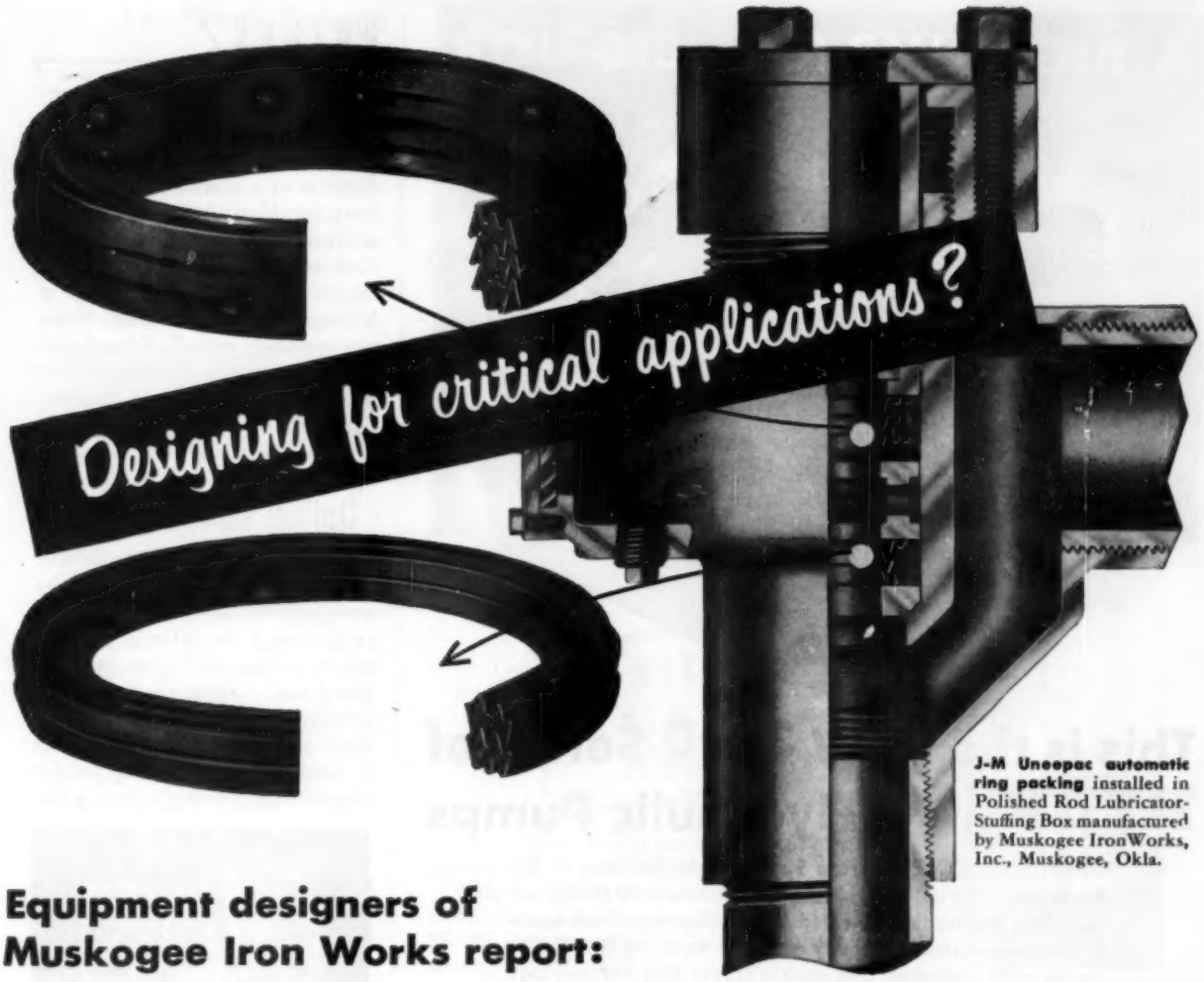
MILLER FLUID POWER CO.

2008 N. HAWTHORNE AVE., MELROSE PARK, ILLINOIS

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATOR
COUNTERBALANCE CYLINDERS



J-M Uneepac automatic ring packing installed in Polished Rod Lubricator-Stuffing Box manufactured by Muskogee IronWorks, Inc., Muskogee, Okla.

Equipment designers of Muskogee Iron Works report:

"Greatly increased packing life... Uneepac guards against pressure damage"

FOR THEIR NEW LUBRICATOR-STUFFING BOXES, design engineers of Muskogee Iron Works needed a packing with long service life as well as foolproof operation. Uneepac, the Johns-Manville automatic ring packing, fully met both of these requirements and contributed to the success and acceptance which the equipment has encountered.

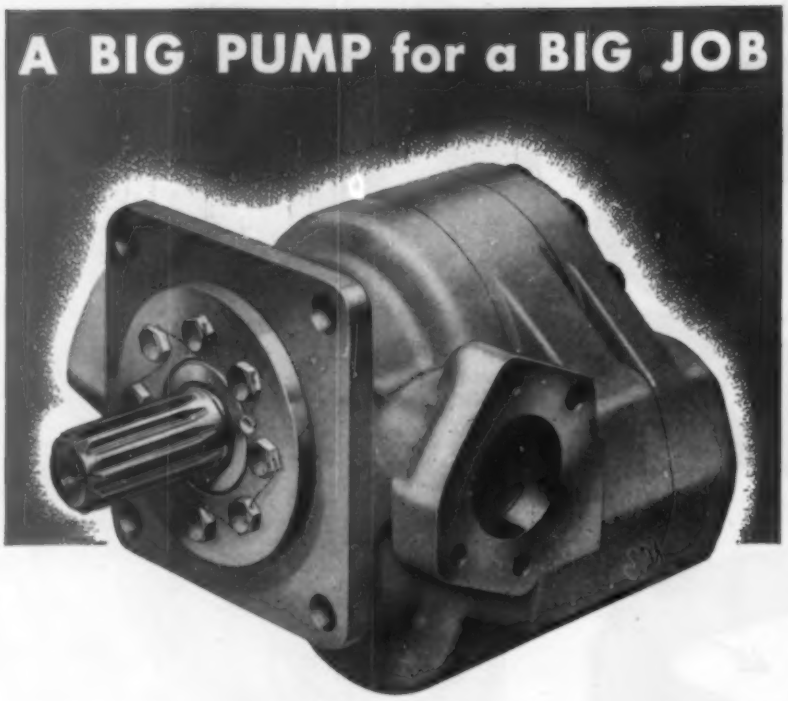
In this application, Uneepac protects itself against damage by excessive gland pressure. The lips of each ring are guarded by the projecting portion of the Uneepac Center section. As a result, far greater service life and reliability is obtainable in this application han with other types of packings.

Uneepac offers many other important advantages for use in pump rods and plungers, compressors and similar equipment. Seals effectively in a minimum of space. Operates with minimum friction. Has excellent pressure sensitivity. Uneepac provides trouble-free operation because each ring positions itself diametrically as well as vertically. Header or follower rings are not always required because each Uneepac ring is a complete, self-protected unit.

To learn how Uneepac may aid your new equipment design, too, write for booklet PK-58A. Just address Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

JM PRODUCT

Johns-Manville PACKINGS & GASKETS



This is the NEW 3600 Series of HYDRECO Hydraulic Pumps

These HYDRECO Pumps are Big News for builders of Big Machines . . . up to 150 Fluid Horsepower output, up to 1500 psi operating pressure! Engineered for installations where space is at a premium and durability essential, these Big 3600 Series Pumps offer equipment designers a proven high volume, high pressure pump. Smooth-operating hydraulic control can now be provided for even bigger designs in mobile and industrial equipment.

3600 SERIES

- 65-90-110 gpm @ 1200 rpm
- Speeds to 2000 rpm
- Pressures to 1500 psi
- Outputs to 150 Fluid Horsepower

The HYDRECO 3600 Series Pumps have been field tested extensively on heavy-duty Mobile Equipment. Operated under the most adverse conditions, even after much abuse, they remained on the job performing efficiently . . . outperforming any other pump previously used in these applications. Downtime for repairs to hydraulic systems was reduced 75-85%. The BIG 3600 Series HYDRECO Pumps really help get the BIG JOBS done easier and more economically.

WRITE for complete information on the new HYDRECO 3600 Series Hydraulic Pumps and companion Control Valves for your BIG JOBS.

HYDRECO DIVISION
THE NEW YORK AIR BRAKE COMPANY
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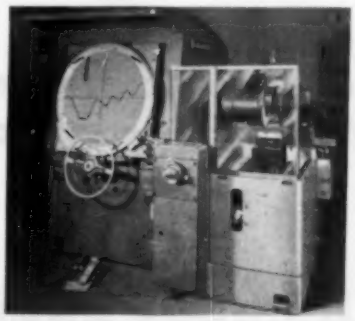
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

BRIEFS continued

Lear, chairman of the board and director of research development, Lear, Inc. Hurst delivered the main address after the initiation exercises which were held at the Society's 50th annual meeting at Michigan State University. Other new members were P. Eduard Geldof, engineering consultant, Whirlpool Corp. and Andrew A. Kucher, director of science laboratory, Ford Motor Company. ▼▼▼

Optical Contour Grinder

Made up of two basic elements, one a special surface grinder equipped with hydraulic tracer control, and the other a 30 inch screen comparator arranged for visual and manual control of the grinding wheel from a contour chart, this machine built by Jones & Lamson, will produce profile ground shapes directly from a line



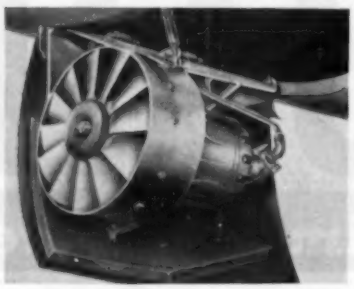
drawing as well as duplicate finished ground profiles by automatic tracer control.

An outline chart showing the enlarged contour of the desired work piece is mounted on the comparator screen and an equally enlarged image representing the cross section form of the grinding wheel cutting edge is projected on the screen. As the grinding wheel position is changed with respect to the work table, the projected image moves in the same direction and in a distance proportional to its enlarged size. Convenient controls permit the operator to advance the grinding wheel along a given work contour. The grinding wheel can also be template controlled by master stylus and hydraulic tracer. ▼▼▼

Air Power Package For Emergency

Designed to bring the airplane home if all other power supplies should fail, a ram-air emergency package, manufactured by Marquardt Aircraft Co., has been installed in the newest Navy jet fighter aircraft.

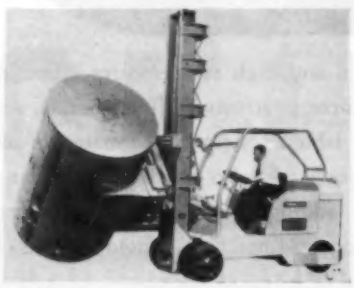
This unit supplies both electrical (alternating and direct current)



and hydraulic power, sufficient to maintain filght control and communication through all speeds. The complete package weighs less than 50 pounds and is rated at 6000 rpm. The unit was developed, in cooperation with Chance Vought, to operate as a "drop-out" type in which a trigger pushes the machine out into the air stream and the air turbine starts rotating immediately to drive the hydraulic pump and electrical generator. ▼▼▼

Giant Paper Rolls Hydraulically Clamped

For use by a manufacturer of paper products to transport, stack and unstack paper rolls, Towmotor



Corporation developed this upending roll clamp. It will handle rolls 40-60 inches in diameter and will raise a 6000 pound roll 210 inches. The 90 degree clamp has one movable shoe on the actuated arm and one fixed shoe on the stationery arm. ▼▼▼

Continued on page 26

... more than double the life of your hydraulic system ... at no additional cost.

Today's production lines cannot afford avoidable machine breakdowns. DUDCO PF-100 Pumps, rated at 2000 psi for continuous operation, provide the extra margin of operating safety which your customers need so badly. The hydraulic system may not require more than 1000 psi — but the extra stamina provided by a 2000 psi DUDCO Pump cuts downtime AND more than doubles the life and dependability of the hydraulic system.

This added safety factor makes sense and saves dollars for the user ... and at the business end of a sale, can make the deciding difference. You pay no premium for DUDCO 2000 psi continuous operation. They cost no more than pumps rated at considerably lower pressures. There's a DUDCO PF-100 Pump in a size and capacity and mountings to fit nearly all standard machine tools.

Users of machine tools can modernize and improve the dependability of their equipment with DUDCO PF-100 Pumps.

TWO VANES ARE BETTER THAN ONE

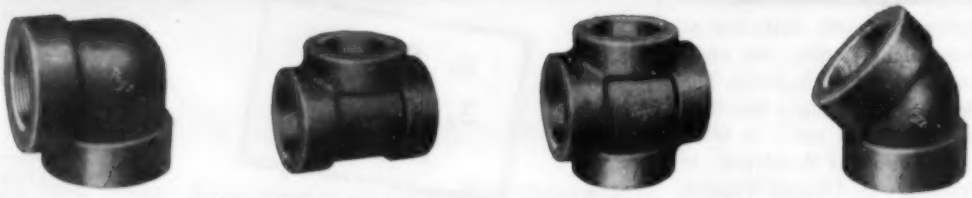
The hydraulically counter-balanced DUAL-VANES in DUDCO Hydraulic Pumps eliminate wear producing loads normally caused by unbalanced hydraulic forces and vane acceleration. DUAL-VANES also maintain MULTIPLE SEALING BARRIERS to slippage and power loss. DUAL-VANES are a patented and exclusive DUDCO feature.

Get the facts on the Dudco PF-100 Dual-Vane Pumps and Fluid Motors. Write today.

DUDCO DIVISION
THE NEW YORK AIR BRAKE COMPANY
1704 EAST NINE MILE ROAD • HAZEL PARK • MICH.
INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

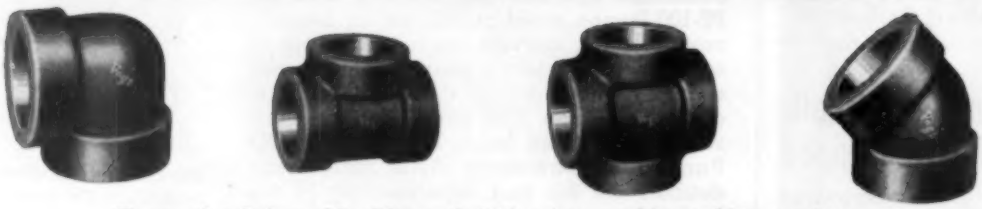
STRENGTH

for Safety and Long-Time Service



For 2000, 3000 and 6000 pounds service — Sizes 1/8" to 6"

SCREW END TYPE



For schedules 40, 80 and 160 pipe — Sizes 1/8" to 4"

SOCKET WELD TYPE

Vogt Ells, Tees, Crosses, etc., are forged from carbon steel or various alloys to meet specific operating conditions. Catalog F-9 will aid you in their selection and proper application.

Address Inquiries to Dept. 24-FAH

Shocks and stresses imposed by high pressures and high temperatures are taken in their stride because Vogt fittings are uniform in structure, fine grained, and free from porosity . . . the superior product of laboratory controlled materials and giant forging hammers and upsetters. These properties also give higher resistance to erosive and corrosive conditions, thereby adding to service life expectancy in steam plants, petroleum refineries, chemical plants and related industries.

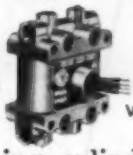
HENRY VOGT MACHINE CO., INC.
Louisville 10, Kentucky

SALES OFFICES: New York • Philadelphia • Chicago • Cleveland • St. Louis • Cincinnati • Dallas • Charleston, W. Va. • San Francisco

Vogt

DROP FORGED STEEL FITTINGS

25,000,000 CYCLES*

Skinner solenoid valves  are ideally suited for use in high-speed production lines. They perform lubricating, cylinder control, blowing and ejecting functions in hundreds of applications, such as drilling stamping, pressing and riveting. Skinner valves provide fast, dependable and trouble-free operation. They're leakproof, rugged, and *simple to inspect.* Available in more than 100,000 variations, so you're sure of finding the valve that is perfect for *your* particular application.

V9 Four-Way

V5 Universal

Call in a Skinner engineer *first* to help you with your solenoid valve problem. With us, no problem is too great, no quantity is too small. Write for Skinner's new solenoid valve catalog . . . on your letterhead, please.

* Special Skinner solenoid valves have proven operable up to 25,000,000 cycles in specific applications.

SKINNER SOLENOID VALVES

SKINNER ELECTRIC VALVE DIVISION • SKINNER CHUCK COMPANY

THE CREST OF QUALITY

SKINNER ELECTRIC VALVES ®

105 Edgewood Avenue
New Britain, Conn.

WORLD-WIDE REPRESENTATION

Circle 85 on Reader Service Card

for extra strength—
full flow—light weight—
specify STRATOFLEX
Elbows
Precision made of Aluminum or Steel. Wide range of sizes and types in standard designs carried in stock. Special designs made to your specifications. Also complete line of airframe hose and engine hose.
Swivel Nut Connection
Write for Aircraft Catalog
Three Hole Flange Fitting
Four Hole Flange Fitting

STRATOFLEX

STRATOFLEX, INC. — FORT WORTH, TEXAS
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BRANCH PLANTS
LOS ANGELES AND TORONTO
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HOUSTON • KANSAS CITY • PORTLAND • TULSA
IN CANADA
STRATOFLEX OF CANADA, INC. TORONTO 18, ONTARIO

BRIEFS continued

Insignia for Authorized Hydraulic Jack Service Depots

Hydraulic jacks, like other mechanical products, require service. To protect hydraulic jack users against inferior service and exorbitant charges, jack manufacturers have carefully selected

franchised service depots. Approximately 150 of these depots throughout the United States and Canada, can be identified by a new insignia distributed by the jack manufacturers. These service stations will have specially trained personnel to perform factory standard repair to hydraulic jacks and other hydraulic power equipment. The new insignia will be given wide publicity to acquaint users of hydraulic jacks to identify and locate these authorized depots. ▼▼▼

Progress Through Research

Construction of the first unit of a multi-million-dollar Borg-Warner Research Center has been started on a 36½ acre site in Des Plaines, Illinois.

Facilities for metallurgical, electric, electronic, hydraulic, applied mechanical, physics and nuclear research will be provided. A complete machine and model shop, a modern computation center as well as a large technical reference library will also be housed in the laboratory. About 100 engineers and scientists will be engaged at the start of the operation. The newest and most modern types of

Continued on page 28

Automate for top performance with . . .

T-J Spacemaker CYLINDERS

CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
40% SPACE SAVED
T-J
T-J
T-J
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

Style SM5 shown

- The Only Cylinders with all the Extras as Standard
- Oil pressure to 750—AIR to 200 P.S.I.
- New Compact Design . . . Saves up to 40% Space
- Proven Performance . . . with Extra High Safety Factor
- Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion
- Hard Chrome Plated Bodies and Piston Rods (Standard)
- Only from T-J can you get these new ingenious cushion designs

More and more of industry's automation problems today—solved with T-J Spacemaker Cylinders! New compact design and many more plus features for a new high in efficient cylinder performance and dependability. Wide range of styles, capacities . . . to help you *save labor, reduce costs* on all kinds of push-pull-lift jobs. Send for bulletin SM-155-1. The Tomkins-Johnson Co., Jackson, Mich.

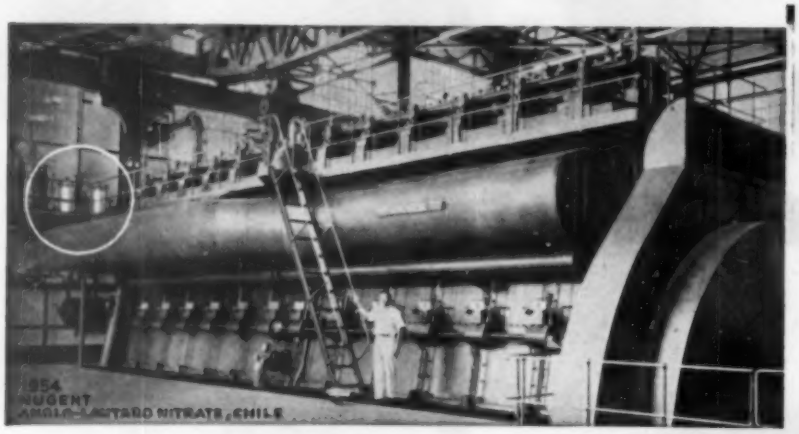
OFF SHELF DELIVERY

Member of the National Fluid Power Association

T-J TOMKINS-JOHNSON

RIVETORS . AIR AND HYDRAULIC CYLINDERS . CUTTERS . CLINCHORS

MOST POWERFUL DIESELS



. . . rely on NUGENT FUEL OIL FILTERS!

● The giant diesel shown above is one of two, 9,600 hp. Nordberg engines installed for the Anglo-Lautaro Nitrate Corporation at their plant in Coya Sur, Chile. The diesels are the most powerful single units ever built in the Western Hemisphere.

Included as original equipment on each of these engines is a Nugent #4L4 twin transfer filter (shown in circle above) for preliminary fuel oil filtering and a Nugent #4L Duplex fuel oil filter (not visible) to provide the final filtering. The Coya Sur installation is another example of Nugent filters being installed as original equipment by a leading diesel manufacturer.

Size for size, Nugent filters of the above type offer greater filtering area than any other filter on the market. In addition, the lubricating oil filters make possible a choice of full flow or by-pass with the same unit. Simple piping makes installation no problem.

No matter what the size of your own diesel power supply—no matter where it is installed, there is a Nugent fuel or lube oil filter to meet your needs. Write for complete information.

← Close-up of a Nugent #4L4 filter of the type used for fuel oil transfer on the giant diesels at Coya Sur. Recharges are inexpensive and simple to replace.

→ Nugent duplex filter of the type used for final fuel oil filtering on the diesels at Coya Sur. By actual test, removes 99.8% of all foreign solids from fuel oil.

Wm. W. Nugent & Co., Inc.
421 N. Hermitage Ave. CHICAGO 22, ILLINOIS

OIL FILTERS, OILING AND FILTERING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS

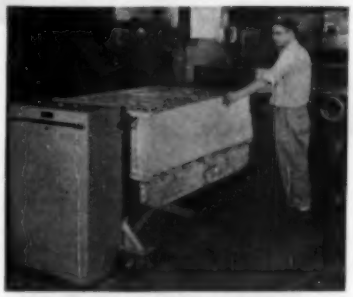
Established 1897

Representatives in Boston • Cincinnati • Detroit • Houston • La Junta, Colo. • Los Angeles • Minneapolis • New Orleans • New York • Philadelphia • Portland, Ore. • San Francisco • Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Winnipeg

BRIEFS continued

equipment will be available for the testing, analyzing and evaluation of new materials, systems, processes and products. Long-range research, product improvement and product development will be performed in this centralized laboratory which when completed will cover 200,000 square feet. ▼▼▼

Hydraulics Simplifies Skid Lift Truck Operation



A new portable skid lift truck which permits the operator of a machine to quickly and smoothly raise or lower a load either on a skid or on the platform, has been added to a line of hydraulic hoists by General Sales and Engineering Co. The operator controls the hydraulic power through an electric push button system. This new unit allows a load to be held in any position at convenient working height, even with the motor shut off. ▼▼▼

UN Exhibit At Atomic Exposition

An exhibit by the United Nations will be seen at the First Nuclear Engineering and Science Congress and Atomic Exposition to be held in Cleveland, December 12-16. Coordinated by Engineers Joint Council, the congress will give the first full scale look at atomic energy in industry, government, agriculture, education and medicine. Nearly 300 papers will be presented at technical sessions describing the latest developments in nuclear engineering and director of research development, science. ▼▼▼

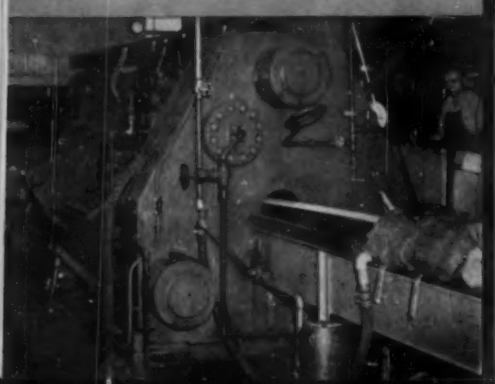
Circle 70 on Reader Service Card

STANOIL
INDUSTRIAL OIL

does heavy chores for
Light Metals Corporation

Tool Room Superintendent Max Chase (left) and Production Engineer Peter Van Dyke (right) with Standard lubrication specialist R. T. Cleland inspect frame of extruded aluminum. Bob Cleland, a graduate of Michigan State with a B.S. in Mechanical Engineering and of Standard's Sales Engineering School, has the background to provide customers with competent technical service on their lubrication problems. This training and experience, customers have found, pay off for them.

Light Metals Corporation uses this 1,250 ton Hydropress for extrusion of aluminum shapes for aircraft, automotive and major appliance industries. Press operates at 2,840 psi in the hydraulic system. Hydraulic medium is STANOIL.



Three years ago Light Metals Corporation, Grand Rapids, put their 1,250 ton Hydropress into operation. The initial fill for the hydraulic system was STANOIL Industrial Oil. The press has operated continuously since its start up. There is no evidence of deposits or varnish anywhere in the hydraulic system. Light Metals Corporation looks forward to many more years of such trouble-free operation.

Why was STANOIL ordered by Light Metals for their Hydropress? The answer is found in the service STANOIL has given in other equipment. Back in 1948 when a Watson-Stillman extrusion press went into operation for Light Metals, STANOIL was chosen as the hydraulic oil. As with the Hydropress, STANOIL has a perfect performance record. The Watson-Stillman press has operated seven years without shutdown because of hydraulic fluid failure.

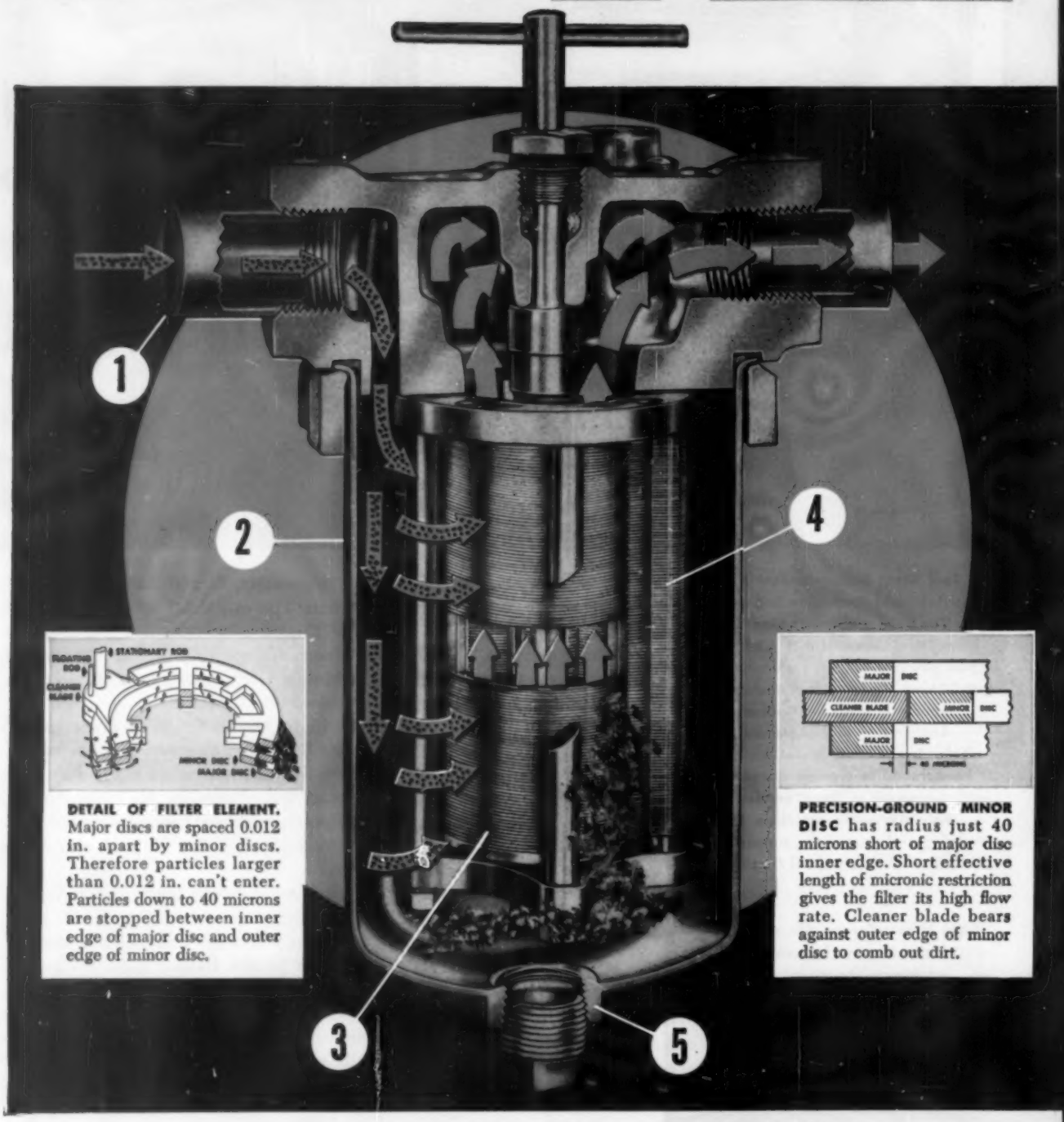
This kind of service from a hydraulic oil means Light Metals Corporation can turn out extruded aluminum shapes for the aircraft, automotive and major appliance industries with high performance and low maintenance factors that mean bigger profits. Reason enough for relying on STANOIL.

STANOIL Industrial Oil can perform for you just as it is doing for Light Metals Corporation. In the Midwest a lubrication specialist from your nearby Standard Oil office will explain how. Call him. Or contact Standard Oil Company, 910 S. Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY
(Indiana)

STANDARD

New! CUNO 40-micron



DETAIL OF FILTER ELEMENT. Major discs are spaced 0.012 in. apart by minor discs. Therefore particles larger than 0.012 in. can't enter. Particles down to 40 microns are stopped between inner edge of major disc and outer edge of minor disc.

PRECISION-GROUND MINOR DISC has radius just 40 microns short of major disc inner edge. Short effective length of micronic restriction gives the filter its high flow rate. Cleaner blade bears against outer edge of minor disc to comb out dirt.

CUTAWAY of new SUPER Auto-Klean. Dirty liquid enters inlet (1) at left, fills housing (2) and flows through metal-edge filter (3) of stacked major and minor discs. Trapped dirt is combed out by cleaner blades (4) when discs are rotated and is removed through drain (5). Clean liquid rises through center of filter element, leaves at right.

self-cleaning filter!

The SUPER Auto-Klean for lube, hydraulic fluid, coolant, fuel and other liquids

. . . and you can clean this filter by simply turning the handle!

Many times smaller than other micronic filters of equal capacity, Cuno's new SUPER Auto-Klean filter now makes possible economical, compact, micronic filtration at high flow rates and eliminates the need for replacement cartridges. On machine tools and industrial machinery, SUPER Auto-Klean gives micronic filtration of lubricating oil, hydraulic fluids, coolants, fuels and other liquids. Here's what it offers:

1. Full-flow micronic filtering with a self-cleaning filter. Filter can be cleaned continuously with motor drive or intermittently by manually turning handle.

2. Eliminates cartridge changes. Ends operating costs if you've been using cartridge filters.

3. No pressure drop build-up. An 8-in. long, 2½-in. diameter cartridge handles 30 gpm of oil of 200 SSU viscosity with only 3 psi pressure drop—up to 75% more with slightly higher pressure drop.

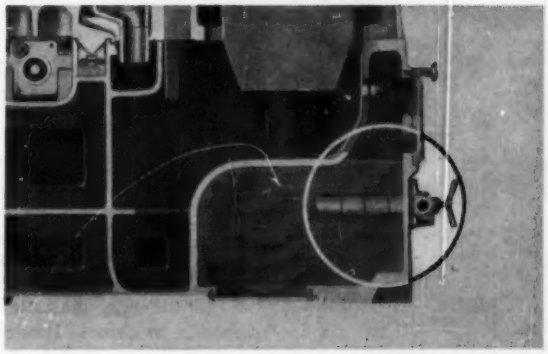
4. Positive protection against particles larger than 40 microns (actually 0.0015 in.). Filter can't rupture or channel.

5. Much smaller than replaceable-cartridge-type filters of equal capacity. It saves with lower initial costs, lower installation costs, requires less space than cartridge units. You get high capacity in a small package.

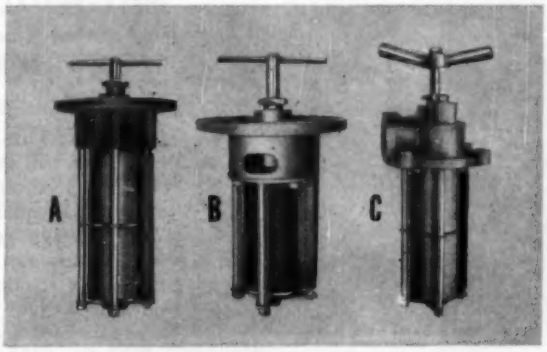
6. No duplex units needed. Handles full flow all the time with no interruptions for cleaning.

7. SUPER Auto-Klean fits existing Auto-Klean housings. You can easily replace most 2¾-in. diameter cartridges with SUPER Auto-Klean for finer filtration.

Send coupon for complete information on the new SUPER Auto-Klean filter, for your new designs or existing equipment. Cuno Engineering Corporation, 20-11 South Vine Street, Meriden, Conn. 5.6



WILL IT FIT? Here's how one designer answered that question. Filter *(circled)* mounts horizontally in side wall of hydraulic fluid reservoir in this surface grinder.



FILTERS FOR INTERNAL PIPING *(A and B above)* allow streamlined design plus the best in filtration. Flange mounting with external outlet *(C above)* and line-type *(cutaway on facing page)* are just two of many other possibilities.

MAIL COUPON FOR COMPLETE INFORMATION

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids from More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge)
FLO-KLEAN (wire-wound) • PORO-KLEAN (porous metal)

CUNO ENGINEERING CORPORATION
2-12 South Vine Street,
Meriden, Connecticut

Please send me full data on the NEW Cuno SUPER Auto-Klean filter.

Name_____

Firm_____

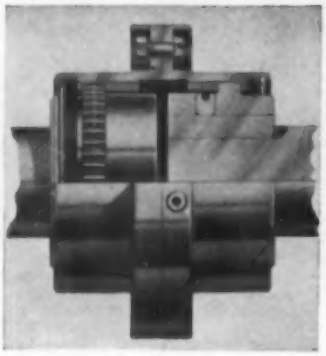
Position_____

Address_____

City_____ Zone_____ State_____

New Products

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.



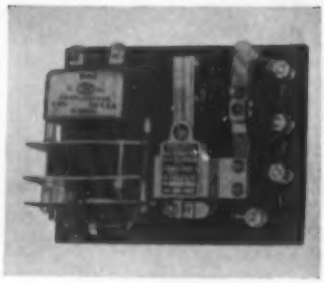
DIHEDRAL COUPLING
. . . is self-aligning up to 3 degrees

Designation: Series 3D

Features: Designed and built on the same principle used in the Series D100 couplings, this new unit will handle misalignment up to three degrees between driving and driven shafts of direct connected machines. Tooth design of this coupling makes it possible to have close tooth clearance. There is no end-of-tooth wear under misalignment as the load is normally carried at the center, and under maximum rated misalignment the driving force is carried across an entire half tooth. Lubricant is sealed in. All couplings are designed for NEMA motor shafts using standard keys.

Ajax Flexible Coupling Co., Inc.
Westfield, N. Y.

Circle 115 on Reader Service Card



DIFFERENTIAL RELAY
. . . for small voltage and frequency variations

Designation: Bulletin 1054-207S

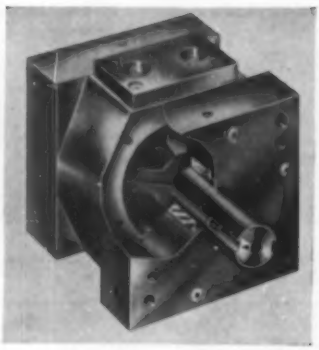
Features: This reduced size, compact relay will drop out at 80 percent to 93 percent of pick-up voltage with frequency held constant. With voltage constant, the relay will pick-up and dropout on variations of a fraction of a cycle. The power relay type contacts used have adequate capacity for direct control of contactors and similar power switching devices.

Applications: These close differential relays can be used in a variety of industrial applications. As voltage relays they can be used to protect electrical equipment against low voltage or over voltage conditions. As frequency relays they can provide over-frequency and under-frequency protection between extremely close tolerances.

Specifications: Relays are available open or closed, one or two poles, normally open or normally closed.

Automatic Switch Company
Orange, N. J.

Circle 116 on Reader Service Card



ROTARY TORQUE ACTUATOR
. . . rotates up to 280 degrees

Designation: Rotomation Motor

Features: The square shaped, ruggedly constructed unit incorporates heavy steel heads, manifold piping and oversize self-lubricating bronze bearings. It will operate with equal efficiency on air, oil, water and fire-resistant fluids. The unit is leak-free and offers lowest possible break-away torque.

Specifications: Mounting of unit can be made on any six faces of 14 mounting models. Four shaft style models are also available.

Applications: For industrial machinery, machine tools, construction equipment, materials handling systems and any types of equipment requiring the movements this unit can execute.

Roto-Mation Motors, Inc.
St. Clair, Michigan

Circle 117 on Reader Service Card

Continued on page 35

It's the BALANCED Synclinal DESIGN

SUMP TYPE (Cutaway)

LINE TYPE (Cutaway)

that makes MARVEL SYNCLINAL FILTERS AMERICAN INDUSTRY'S A-1 CHOICE

In the plants of America's industrial giants, as well as in smaller plants, Marvel Synclinal Filters are installed on all types of hydraulic and other low pressure liquid circulating equipment. Marvels are chosen because of their excellent performance in protecting machines and increasing production by reducing down time. They are proving again and again, their superiority in the one real test—ON THE JOB! The BALANCED Synclinal Design of Marvel Filters provides that all-important balance between maximum ACTIVE filtering area and sufficient storage space for filtered out particles—therefore, longer periods of productive operation are attained at the absolute minimum of maintenance. They meet J. I. C. Standards.

EASY MAINTENANCE—Both sump and line type filters may be easily disassembled, thoroughly cleaned and reassembled by any workman, on the spot, in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

Not only plant operators, but also, OVER 600 ORIGINAL EQUIPMENT MANUFACTURERS have recognized the superiority of Marvel Synclinal Filters and now install them as standard equipment.

SPECIFY MARVEL SYNCLINAL FILTERS ON NEW EQUIPMENT--
STANDARDIZE WITH MARVELS ON EXISTING EQUIPMENT

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G. P. M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

IMMEDIATE DELIVERY!

As in the past, MARVEL continues to offer IMMEDIATE DELIVERY.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

Catalogs containing complete data available on request

MARVEL ENGINEERING CO.
7227 N. HAMLIN AVE., CHICAGO 45, ILL.
PHONE: JUniper 8-6023

Without obligation, please send me complete data on Marvel Synclinal Filters as follows:

Catalog No. 106 for Hydraulic Oils, Coolants, Lubricants
Catalog No. 300 for Water
Data on filters for fire-resistant hydraulic fluids

AH-12

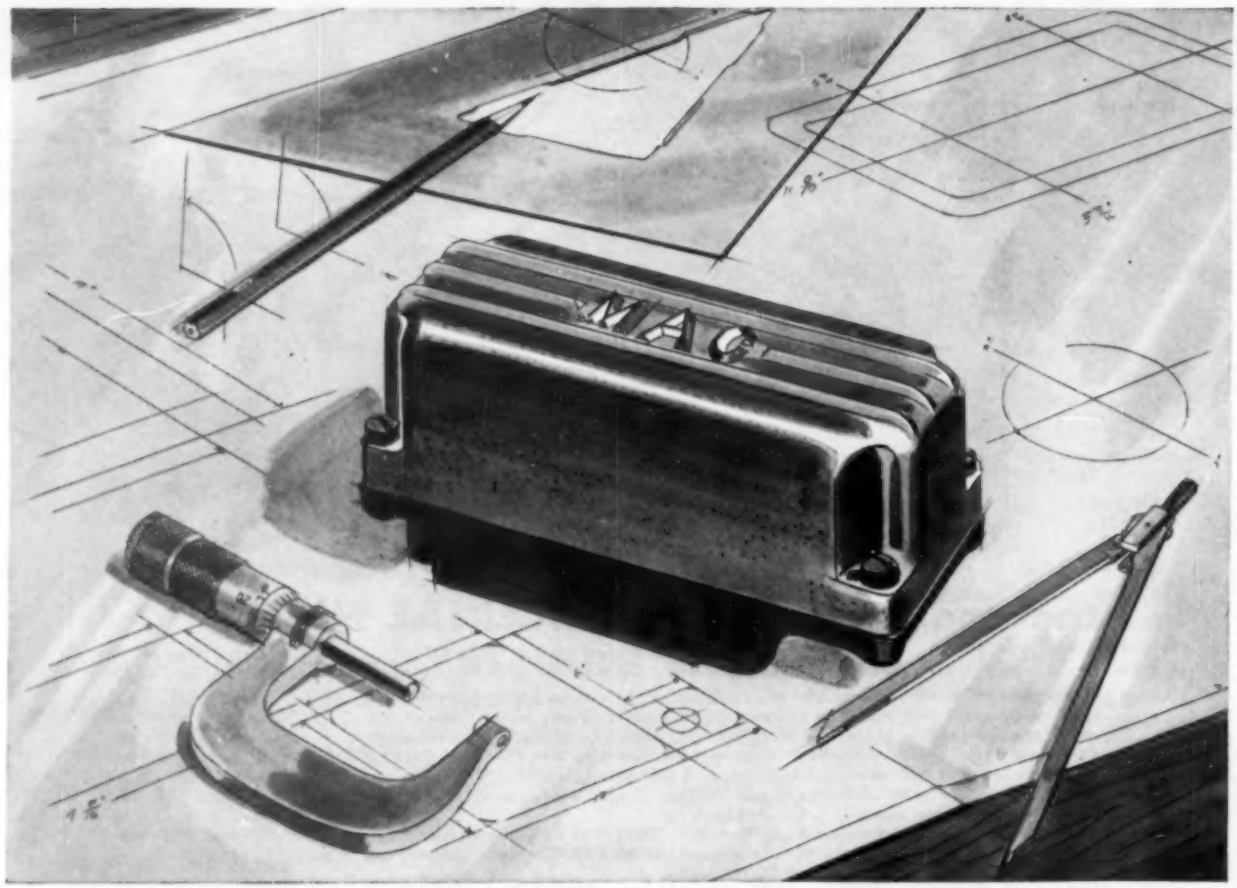
Name ..... Title .....

Company .....

Address .....

City ..... State .....

WELL CALIBRATED TO KEEP YOU IN OPERATION!



You've seen it happen. An air valve fails—a key piece of equipment goes down—production grinds to a halt. Time, quotas and money are lost, never to be recovered.

But here at MAC we take the downtime out of valves before they leave the plant. Here, where we believe air valves are made more carefully and expertly than anywhere else, every spool, every spring, every solenoid is checked and rechecked. Every valve is tested and retested under conditions as rugged as we can make them. And every valve is *right*, or it doesn't get shipped. Add to this the fact that MAC valves pace the industry for simple, sound design and you'll have an inkling of why MAC has earned a reputation for long, dependable operation for millions of maintenance-free cycles . . . why MAC is well calibrated to keep you operating.

Test a MAC valve in your plant. We have 92 sizes and types—one for virtually any application. Phone a MAC representative, at right, or send for free literature.

MECHANICAL AIR CONTROLS, INC.
10030 Capital, Oak Park, Detroit 37, Michigan

MAC

PHONE YOUR NEARBY "MAC" REPRESENTATIVE FOR DATA AND DELIVERY

CALIFORNIA
OAKLAND 8—The Rucker Co., 4700 San Pablo Ave., OLympic 3-5221
SOUTH GATE—The Rucker Co., 4956 Firestone Blvd., KImball 8271

ILLINOIS
CHICAGO 43—Mike C. Modrich & Co., 10336 South Western Ave., HIlltop 5-3640

INDIANA
FORT WAYNE 3—Neff Engineering Co., P. O. Box 2001, Station A, 2339 Crescent Ave., EAstbrook 7391
INDIANAPOLIS 20—Neff Engineering Co., P.O. Box 7361, 42nd St. Station, BRoadway 2330
SOUTH BEND—Dick Futter, 103 South Varsity Dr., 2-4856

MARYLAND
BALTIMORE 6—Grand Air-Hydro Division, K. William Ostrom & Co., Inc., 6105 Alta Ave., HAmilton 6-6669

MASSACHUSETTS (and New England)
BOSTON 34—Electrical Apparatus Co., Inc., 1200 Soldiers Field Rd., STadium 2-7440

MICHIGAN
BAY CITY—Fred Kober, 506 Chilson St., 2-2629
FLINT—Kober Sales Engineering Co., 514 Beach St., CEdar 8-5123
GRAND RAPIDS—C. H. Berry Co., 909 Northland, N. E., EMpire 1-8101

MINNESOTA
MINNEAPOLIS 4—Air Engineering & Supply Co., 2445 Nicollet Ave., FIlmore 5579
ST. PAUL 14—W. H. Schulz Co., 2438 Franklin Ave., Midway 2744

MISSOURI
ST. LOUIS COUNTY—Oscar E. Jost Co., P. O. Box 6, St. Ann, HArrison 8-4488

NEW JERSEY (Northern)
CRANFORD—The Roden Company, P. O. Box 305, CRanford 6-7330

NEW YORK
BUFFALO 21—C. H. Tepas Co., 200 Washington Hwy., Circle 3210

OHIO
CINCINNATI—The R. W. Nichols Co., Fidelity Federal Savings Bldg., 2087-9 Sherman Ave., Norwood, ELmhurst 2440
DAYTON—The R. W. Nichols Co., 407 Realty Bldg., Michigan 4724
OLMSTED FALLS—The R. W. Nichols Co., P. O. Box 6, BErea 4-1379
YOUNGSTOWN 3—The R. W. Nichols Co., 202 Schwenn-Wagner Bldg., Riverside 4-4550

OREGON
PORTLAND—The Rucker Co., 911 N. W. Hoyt St., BEacon 0205

PENNSYLVANIA
PHILADELPHIA 4—Grand Air-Hydro Div., K. Wm. Ostrom & Co., Inc., 3717 Filbert St., EVergreen 2-5444
PITTSBURGH 22—The R. W. Nichols Co., 101 Investment Bldg., ATlantic 1-6050

TEXAS
DALLAS 19—Womack Machine Supply Co., Shea Rd. at 7200 Harry Hines, DIxon 6997

WASHINGTON
SEATTLE—The Rucker Co., 101 Jones Bldg., Rm. 203, MAin 2783

WISCONSIN
MILWAUKEE 17—Neff Engineering Co., 5856 N. Pt. Washington Rd., EDgewood 2-1579

CANADA
ONTARIO, HAMILTON—Higginson Engineering Sales, P. O. Box 23 (275 James, North), JAckson 9-2262

MECHANICAL AIR CONTROLS, INC.
DETROIT 37, MICHIGAN

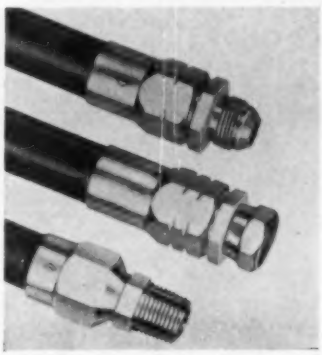
MAC

New Products continued

HOSE AND COUPLINGS
. . . for high pressure applications

Designation: Hi-Duty

Features: Hose conforms to both SAE and JIC standards. The line includes single wire braid, rubber covered hose; double wire braid, rubber covered hose; and single wire braid, cotton covered hose. For each type a wide range of hose couplings and adapters is offered. A simplified identification system



makes the use of hose and couplings very easy.

Applications: For hydraulically operated equipment, machine tools, die casting machines, oil field machinery, industrial lift trucks, welding machines and other equipment.

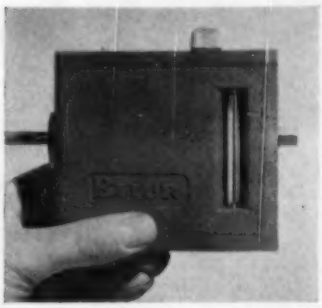
The Imperial Brass Mfg. Co.
Chicago, Ill.

Circle 118 on Reader Service Card

AUTOMATIC LUBRICATOR
. . . uses constant-pressure rotary pump

Features: Unit maintains a continuous oil film of constant thickness on critical bearing surfaces. A pressure of 20 psi is maintained by the lubricator throughout the distribution system and at the lubrication points.

Operation: The device includes an inlet filter and a reservoir level gauge. The lubricator shaft, operated at 1800 rpm is driven either from a convenient shaft on the machine or by a direct connected 1/20 hp motor. The volume of oil delivered by the lubricator is dependent upon the pressure maintained in the system.



Applications: Designed for use on equipment which must work to very close tolerances.

Bijur Lubricating Corp.
Rochelle Park, N. J.

Circle 119 on Reader Service Card

FILTER CARTRIDGE
. . . made of fiber glass

Designation: Glas-Kleer

Features: To fit standard filter containers, these cartridges are offered in 2, 10, 25 and 50 micron grades. Fine glass fibers were chosen

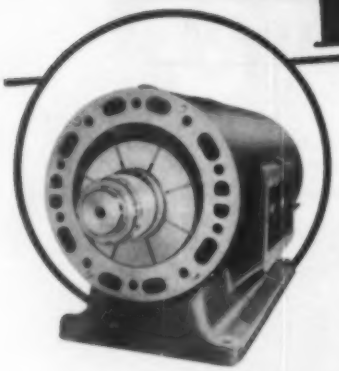
for their high chemical and temperature resistance and non-absorbent structure. Each cylinder is lined with fiber glass cloth to insure lint-free filtration and is provided with variable density to insure long service life and high holding capacity.

Porous Plastic Filter Co., Inc.
Glen Cove, N. Y.

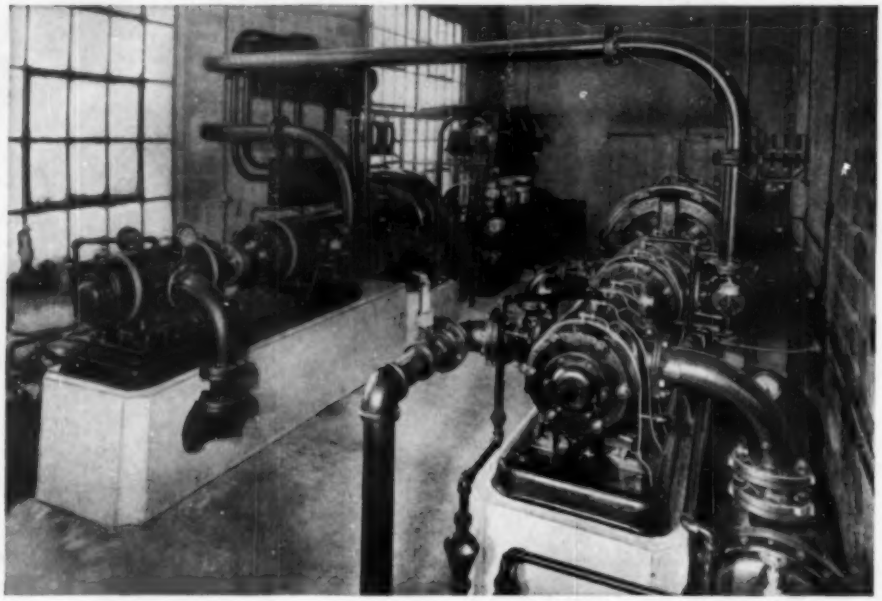
Circle 120 on Reader Service Card

For more NEW PRODUCT reviews turn to page 102

Fuller *pioneered*



the two-stage **rotary** compressor . . . for general industrial use . . . starting in 1930



INSTALLED 1930
STILL GOING STRONG

Two Fuller Rotary Two-stage Compressors. Capacity each 740 c.f.m., 100-lb. pressure.

Fuller Company not only pioneered the rotary compressor for industrial use in this country, but it has always stressed the "spotting" of compressors. There's nothing new or startling about this principle . . . Fuller has advocated it ever since its first machines were put on the market in 1930 . . . applying each compressor to a specific job, with resultant overall plant economy, as well as power savings. Result: the adoption of this economical layout by thousands of users has proved to their satisfaction the soundness of such a program.

Fuller has built and sold thousands of Fuller Rotaries—a large proportion of the two-stage type. And, when plant expansion is necessary, with a consequent demand for more air, additional Fullers are naturally installed.

Fuller engineers have never rested on their oars, but have continually worked to improve design and efficiency, until today, these machines are second to none for dependable air-production in industry.

We welcome the opportunity to present to you all the facts concerning Fuller Rotary Compressors, facts built on actual operational experience. For a complete description of Fuller Rotaries, write for Bulletin C-5A.

You're invited to visit Fuller at Booth 213 at the Chemical Show, Philadelphia, Dec. 5-9.

FULLER COMPANY, Catasauqua, Penna.

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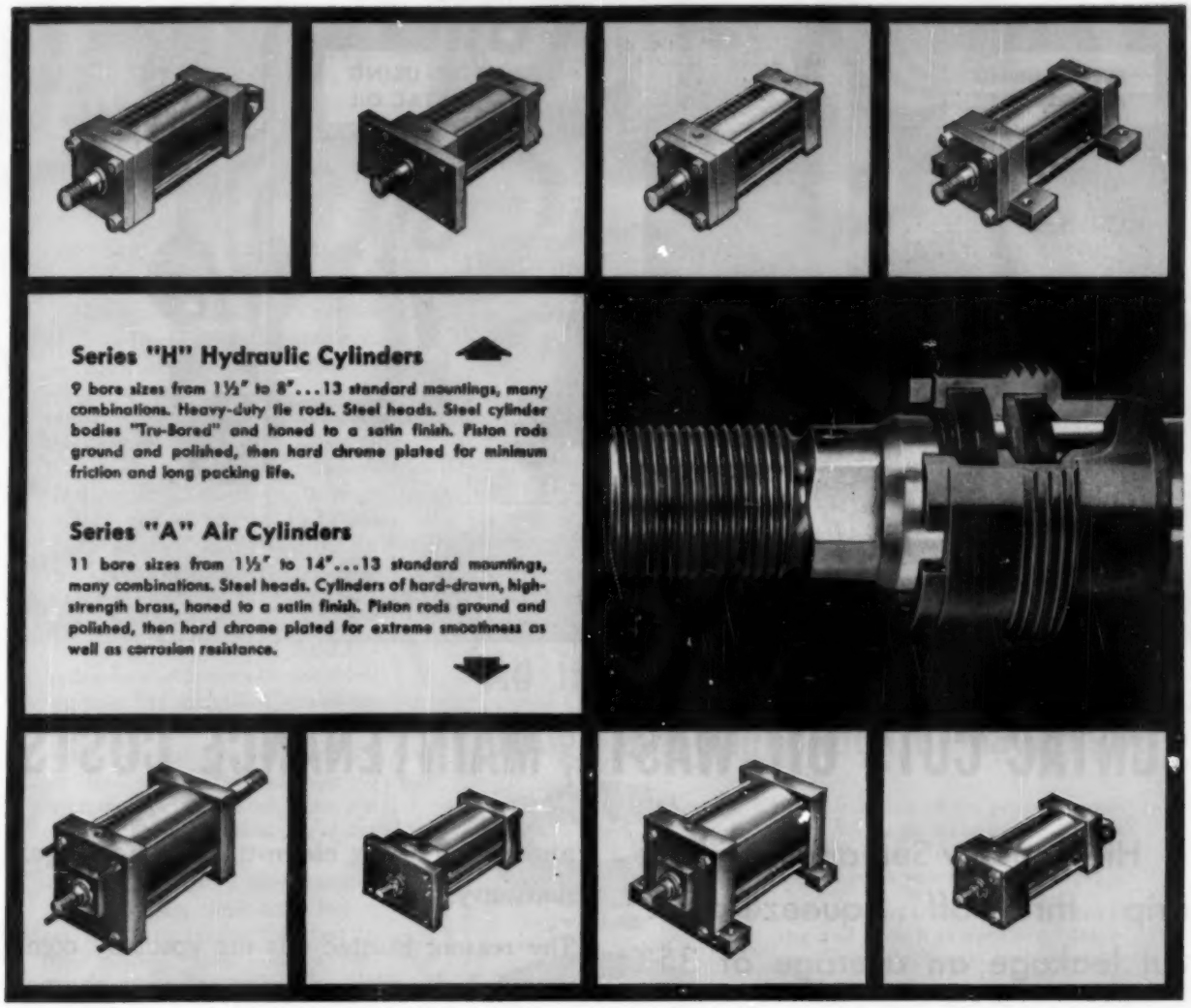
C-275
1783

Fuller

PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930



Series "H" Hydraulic Cylinders

9 bore sizes from 1½" to 8"...13 standard mountings, many combinations. Heavy-duty tie rods. Steel heads. Steel cylinder bodies "Tru-Bored" and honed to a satin finish. Piston rods ground and polished, then hard chrome plated for minimum friction and long packing life.

Series "A" Air Cylinders

11 bore sizes from 1½" to 14"...13 standard mountings, many combinations. Steel heads. Cylinders of hard-drawn, high-strength brass, honed to a satin finish. Piston rods ground and polished, then hard chrome plated for extreme smoothness as well as corrosion resistance.

Only HANNIFIN Square-Type Cylinders Have This Revolutionary New Gland

The gland you see here represents the biggest improvement in cylinder design in the last 50 years. And, you'll find this gland only in Hannifin Square-Type Air and Hydraulic Cylinders.

This exclusive Hannifin Gland is a bronze cartridge, *externally removable and replaceable as a unit* to meet J.I.C. recommendations. The packing is new, too. Outside is the "Wiperseal." It serves a dual purpose as it *wipes both ways* to provide a dry rod on the out-stroke, a dirt-free rod on the in-stroke. Inside is the "Lipseal"...self-compensating, self-relieving and nonadjustable. It provides an efficient seal throughout its long life.

Find out how easily you can apply Hannifin Cylinders to your requirements. They're available for prompt delivery—in all sizes and all standard mounting styles—and at competitive prices despite all their exclusive features.

WRITE FOR BULLETINS

Bulletin 113. Series "H" Hydraulic Cylinders

Bulletin 213. Series "A" Air Cylinders

HANNIFIN

Hannifin Corporation, 545 S. Wolf Rd., Des Plaines, Ill.
Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

SUNTAC CUTS OIL WASTE, MAINTENANCE COSTS

High quality Suntac oils reduce drip...throw-off...squeeze-out... cut leakage an average of 35% and up to 90% in some cases.

Before using Suntac oil, a prominent eastern manufacturer had to add excessive make-up oil to the hydraulic system of his freight elevator. Oil leakage caused a continual housekeeping problem...the pit had to be cleaned out every six to eight weeks and maintenance costs were high.

Now, one year after switching to a Suntac oil, make-up has been drastically reduced, and frequent pit clean-ups are no longer necessary.

The reason: Suntac oils are specially compounded oils with adhesive-cohesive characteristics that enable them to cling to parts where other oils would drip, throw-off, leak, and squeeze out.

For complete information about Suntac oils, see your Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AH-12.

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INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY, PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

LETTERS
to the editor

BETTER MANUFACTURERS' CATALOG

This letter is inspired by a series of visits from sales engineers from various manufacturers, each of whom naturally expected me to prefer his company's product on the basis of information allegedly contained in printed matter left with me. After reading this information, or lack thereof, I came to the conclusion that some of the best manufacturers need a thorough revision of their catalogs.

General acceptance of the J.I.C. hydraulic and pneumatic graphical symbols has simplified drawings. A pneumatic or hydraulic system can be reduced to symbols so simple that any person capable of reading a blueprint can trace out the operation of even the most complex circuit.

Yet today, with a few outstanding exceptions, most manufacturers prefer to ignore this fact in their catalogs. Most catalogs, particularly those of valve and control manufacturers where it is needed most, omit the simple circuitry representation in favor of a detailed, and necessarily quite complicated, description of the flow. These descriptions are usually assisted by sectional views, or cutaway perspective views, showing the flow of fluid through the valve.

The pictures, after study, generally yield a far better understanding of the function than the text. However, neither text nor picture is quite so simple, to the designer, layout draftsman, or detailer, as the correct J.I.C. symbol.

The most successful representation, seems to be simple 3-view dimensional drawing (usually omitted), accompanied by the J.I.C. symbol, and the text. This comprehensibility is borne out by the fact that, while the designer himself may have preferences as to a choice of manufacturers based

Continued on page 44

IF YOU DESIGN OR USE CYLINDERS AND PRESSES

...you'll want

RHOADS

New PACKING HANDBOOK

An invaluable reference for the design and application of packings

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VEE PACKING

FLANGE PACKING

CUP PACKING

Here it is, just off the press, Rhoads new 56 page handbook on the design and application of hydraulic and pneumatic leather packings!

Every subject from "What is a packing and how it is used" to "Maintenance of Packings" is thoroughly covered.

Written and edited by the leading manufacturers of mechanical leather packings, the data and principles contained in it have been approved by the leather packing industry.

This book is a publication of the National Industrial Leather Association of which J. E. Rhoads & Sons is a member.

As a contributor to this book and the manufacturer of famous Tannate Leather Packings, J. E. Rhoads & Sons will be happy to send you a copy. Please use the coupon below or write on your business letterhead.

J. E. Rhoads & Sons
2100 W. 11th St., Wilmington 99, Del.

RHOADS
INDUSTRIAL LEATHERS

Gentlemen:
Please send me a free copy of Rhoads new Packing Handbook. No obligation, of course.

*Name*_____ *Title*_____

*Firm*_____ *Street*_____

*City*_____ *Zone*_____ *State*_____

Circle 82 on Reader Service Card

right now...

Swaged Hose Assembly Service

....AT YOUR WEATHERHEAD

DISTRIBUTOR

ANY HOSE ASSEMBLY MADE IN 3 MINUTES

Right in His Own Service Shop

Now, for the first time, your Weatherhead distributor offers you complete swaged hose assembly service right in his own shop. No waiting for shipments of factory-finished hose assemblies. No need for costly downtime and delay. Equipped with the new Weatherhead swaging press and the complete line of Weatherhead hydraulic hose and hose ends, your distributor is prepared to supply you with any size, type and length hose assembly at once.

Wherever you are, whatever your need, there is a Weatherhead distributor strategically located to give you immediate stand-by swaged hose assembly service.

WEATHERHEAD LEADS THE WAY

now available

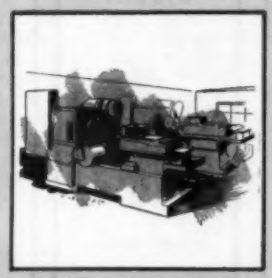
at Weatherhead Distributors

ON-THE-SPOT SWAGING SERVICE FOR HYDRAULIC HOSE ASSEMBLIES

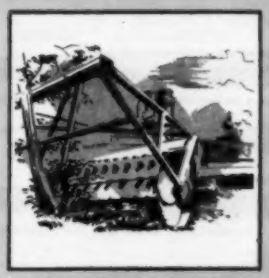
Any Size . . . Any Type . . . Any Length . . .

The complete range of sizes from ¼" to 2" I.D. in the Weatherhead full line of hose and hose ends, eliminates any delay in completing the job. Be assured of safe, trouble-free service by specifying Weatherhead for all your hose assembly needs. The Weatherhead complete line of fittings and hose is as near as your phone. Call your local Weatherhead distributor today for immediate service.

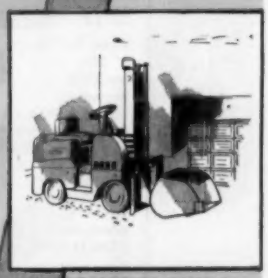
RIGHT AWAY SERVICE
For mining and oil drilling fields.



RIGHT AWAY SERVICE
For all types of manufacturing operations.



RIGHT AWAY SERVICE
For construction and farm machinery.



RIGHT AWAY SERVICE
For hydraulic materials handling equipment.

Turn the page

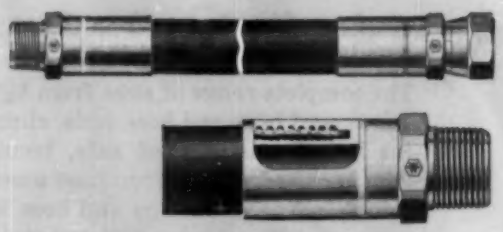
WEATHERHEAD

WEATHERHEAD DISTRIBUTORS

Your reliable source for "RIGHT-NOW" Hose Assembly Service

Weatherhead swaged hose assemblies match factory-made assemblies in every respect. They are available in any quantity, length, type or size to meet your needs. Now made-to-order hose assemblies are available at once through your local Weatherhead distributor at no additional cost. Your downtime is cut to a matter of minutes because your order can be made up on Weatherhead swaging equipment right in your Weatherhead distributors own service shop.

Take advantage of your Weatherhead distributor's dependable RIGHT-NOW hose assembly service. Save money. Reduce downtime.



TYPES OF HOSE

H-17 TWO FIBRE BRAID • MEDIUM PRESSURE

sizes: ¼" to 1" I.D.
working pressures: 550 to 1250 p.s.i.

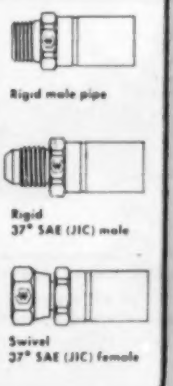
H-104 ONE WIRE BRAID • MEDIUM PRESSURE

sizes: ¼" to 1" I.D.
working pressures: 1250 to 2500 p.s.i.

H-425 TWO WIRE BRAID • HIGH PRESSURE

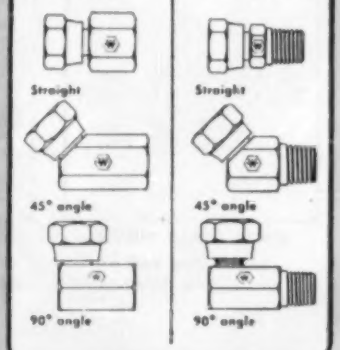
sizes: ¼" to 2" I.D.
working pressures: 1250 to 4500 p.s.i.

TYPES OF HOSE ENDS



SWIVEL ADAPTERS

These swivel adapters permit a wide range of hose end combinations



WEATHERHEAD LEADS THE WAY

WEATHERHEAD... your only complete "single-source" Hydraulic Hose and Fitting Line ...FIRST IN COMPONENTS FOR HYDRAULIC SYSTEMS

An INDUSTRIAL HOSE for every need — low, medium-high and high-pressure applications; in complete size ranges to 2" I.D.; suited for any service condition.

REUSABLE HOSE ENDS for fast assembly and positive, leak-proof connections. Rugged construction that cuts costs through repeated use. Designed to insure maximum flow.

ERMETO® reusable hose ends for connecting hose assemblies directly to block or manifold are also available from stock in standard sizes. Specified by major diesel manufacturers for high-pressure fuel injection lines.

Only Weatherhead gives you hose ends with extra-long gripping area for dependable performance under high pressures.

ERMETO® fittings in steel and stainless steel for leakproof seals without flaring, threading or welding. Withstand shock loads, vibration and impulse at highest pressures. Ermeto connections can be uncoupled and reassembled time after time.

37° FLARED STEEL FITTINGS conform fully to J.I.C. standards. Available in all types and sizes with tube or dry seal pipe thread outlet.

BRASS FITTINGS—S.A.E. 45° flare, compression, inverted flare, double compression (threaded sleeve), are machined from extruded stock, giving strength equal to forgings. Large, flat wrench pads provide easy gripping for fast assembly, even in hard-to-reach places.

There's an experienced Weatherhead field engineer ready whenever you need him to help you take full advantage of all that Weatherhead offers.

THE WEATHERHEAD CO., FORT WAYNE DIVISION
DEPT. A-12, 128 WEST WASHINGTON
FORT WAYNE, INDIANA

SEND FOR FULL DETAILS TODAY!

The Weatherhead Co., Fort Wayne Division
128 West Washington, Fort Wayne, Indiana
Send full details on your Distributor's stand-by swaged hose assembly service.

Company_____
Address_____
Your Name_____

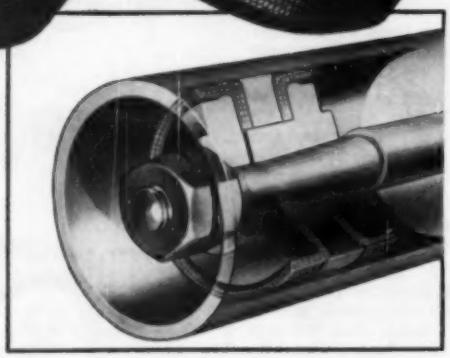
A-12

PUMCUP ADVANTAGES

now yours for

- HYDRAULIC CONTROLS
- AIR CYLINDERS
- RECIPROCATING PUMPS

Two common Pumcup types: conventional and 45° bevel type . . . available in a complete range of sizes and texture-engineered compositions.



Cutaway view of typical Pumcup installation resulting in prolonged high efficiency.

TAKE it from experienced users, Darcova Pumcups offer payoff advantages that can't be equalled! For example, they last many times as long as ordinary piston packing . . and they *hold peak efficiency* from start to finish. Because of the resulting production and maintenance economies, plant after plant is standardizing on Pumcups.

Improved application of the cup principle does the trick. And Darcova Pumcups are *texture-engineered* in *a range of compositions* to meet most temperature-pressure-fluid conditions. And they are available in sizes and types exactly right for your particular equipment.

It will pay you to get *all* the facts. Just ask for Pumcup Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP
TRADE MARK
PUMCUPS

LETTERS to the editor

on wide experience, the people who specify the supplier in the bill of materials on a drawing are most often influenced to specify, along with the designer's choices, the manufacturer whose product they feel surest will fit the job at hand. And that is invariably the one whose product those at specification level understand. So, quite naturally, the manufacturer with the clearest product representation has a definite advantage.

From the designer's standpoint, it is easy to see why he will more often choose to lean toward selection of a product on which he must spend a minimum of selection time. Unconsciously often due to pressure of time, he will take the easy way out, especially in a choice between reputable manufacturers whose products are equally reliable.

It is not suggested that either the text or the cutaway drawings be dropped from catalogs. Rather, let them be simplified and supplemented both by symbols and complete dimensional drawings so that the component described may become as immediately comprehensible as possible. It is further suggested that, typical applications be included, and pressure drops under recommended flow conditions should also be covered. It would not be too much to expect to find scale layout templates offered on request.

W. DONALD KUNTZ
Development engineer
Engineering and Research Div.
ACF Industries, Inc.

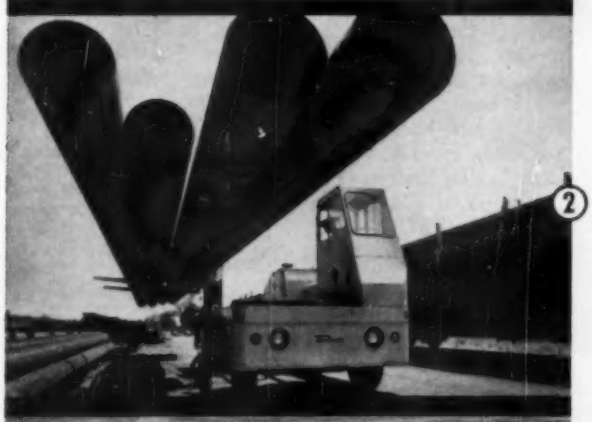
Silicate Fluids

In the June issue, the article reporting the S.A.E. aircraft meetings mentions silicate fluid 720173C as one of the more promising fluids for high temperature applications. We would like technical data on this fluid. Can you help us?

ROBERT P. CAMERON
British Messier Ltd.
Gloucester, England

We've referred your request to the R. M. Hollingshead Corporation who can give you information.

NEW VEHICLES
FOR
NEW PERFORMANCE



VICKERS®

HYDRAULIC SYSTEMS

for All Types of

MOBILE

EQUIPMENT

Vickers Hydraulic Systems make vital contributions to the efficient operation of an extremely wide range of vehicles. To the inherent advantages of hydraulic control, Vickers adds the benefits of a nation-wide and full time field engineering and service organization of unequaled experience. Vickers has the complete line of hydraulic equipment necessary to take undivided system responsibility . . . to eliminate any risk of incompatibility of hydraulic components. Ask for a copy of Bulletin M5101.

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DIVISION OF SPERRY RAND CORPORATION
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IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

Engineers and Builders of Oil Hydraulic Equipment Since 1921

7354

① **AUSTIN-WESTERN HYDRAULIC CRANE**
In addition to power steering, Vickers Oil Hydraulics provide fast, smooth and positive (a) turntable rotation, (b) boom elevation, (c) raising and lowering of load, (d) extending and retracting of boom.

② **BAKER-RAULANG TRAVELOADER**
Vickers Hydraulics provides power steering and multiple movements that enable Traveloader to quickly reach out sideways and pick up a long load, place it on the vehicle's deck for traveling, and then stack it up to 12' high.

③ **DART UNDERGROUND TRUCK**
Vickers Hydraulics operates the reversible conveyor floor that permits fast and easy trim when loading, and then rapid dumping. Also has Vickers Hydraulic power steering for shuttle operation.

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

MANUAL PUMPS . . . cylinders, rams, and jacks are featured in 36-page Catalog 555 presented by Star Jack Co., Inc. Photographs and specifications of each component are given in the attractive catalog. Hand pumps are designed with overload relief valves, hard chrome plated pistons, hand-operated cam release, and all-steel construction. They are made for maximum operating pressures to 10,000 psi. Single-acting and double-acting hydraulic cylinders are shown as well as double acting air cylinders. The hydraulic rams feature a high pressure self-sealing coupler which allows rapid connection and disconnection of pump and ram. Center hole rams not only push or lift, but also pull through their center hole without bulky rigging or auxiliary equipment.

Circle 170 on Reader Service Card

PRESSURE REDUCING VALVE . . . for inlet pressures of 500 to 4000 psi and outlet pressures from 400 to 3000 psi is presented in Bulletin S-731 from A. W. Cash Co. Included in the bulletin are a photograph and cross-sectional drawing illustrating the operation of the valve. Formulas are given for determining the correct valve size according to fluid flow, inlet and outlet pressures, and specific gravity of the fluid. The valve is piston-operated and is fitted with O-ring seals to minimize friction. An internal strainer screen crimped around the cylinder of the working unit protects the seat from foreign matter. The body cap is bolted and can be easily removed to inspect the internal parts or to service the valve without removing it from the line.

Circle 171 on Reader Service Card

HYDRAULIC CYLINDERS . . . and other components manufactured and sold by Palley Supply Co. are shown in a 32-page catalog available from the company. A great variety of government surplus special cylinders are shown and prices are quoted. A number of 4-way hydraulic valves, relief sequence, solenoid, plug, check, and manual shut-off valves are also shown. Hydraulic accumulators of the ball type and piston type are shown as well as metering valves, air and oil filters, pumps, hand pumps, hose, fittings, and miscellaneous components including pressure switches, snubbers, and pressure gages. A section is included giving hydraulic data and showing circuits with double acting cylinders, hand pump, and accumulator.

Circle 172 on Reader Service Card

RESTRICTOR VALVES . . . for 3000 psi hydraulic service are covered in Data Sheets Series 1100 offered by Aircraft Products Co. The valves are available in both fixed 2-way and fixed 1-way types. The fixed 2-way type restricts flow in either direction and contains a fixed orifice in the center to filter either side. The fixed 1-way type restricts flow in one direction and is fully open in the other. The valve contains an orificed poppet with integral filter. The valves have either internal or external threaded ends for the tube sizes of ¼, ⅜, and ½ inch. The valves are made from aluminum, stainless steel, or special alloy bodies and have ambient temperature ranges from –65 to 275 F. Special models withstand temperatures of 400 F.

Circle 173 on Reader Service Card

AIRCRAFT FITTINGS . . . and hose manufactured by Aeroquip Corp. are specified in a new 78-page catalog prepared by the company. The publication provides an up-to-date source of reference on flexible aircraft plumbing including flexible hose, reusable fittings, self-sealing couplings, hose assemblies and other fluid line components for aircraft applications. Sizes, operating pressures, temperatures, and other engineering data are presented in simplified form to aid aircraft designers in fluid system planning, selection, and installation.

Circle 174 on Reader Service Card

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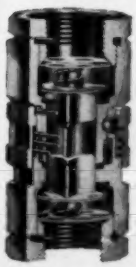

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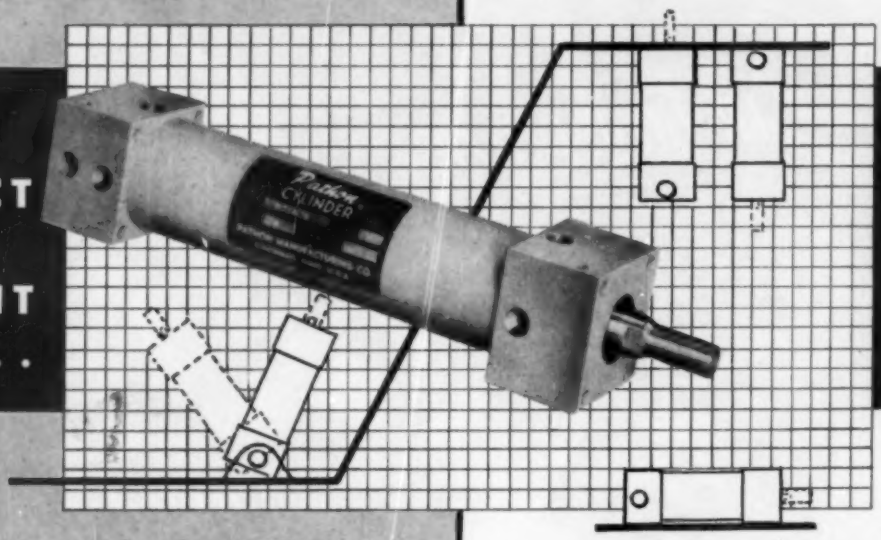

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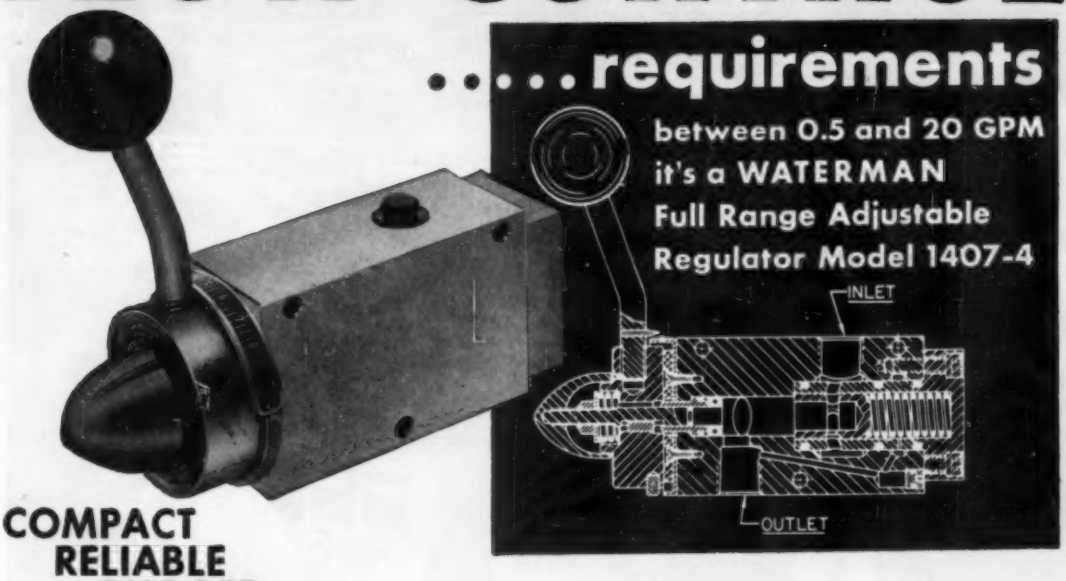

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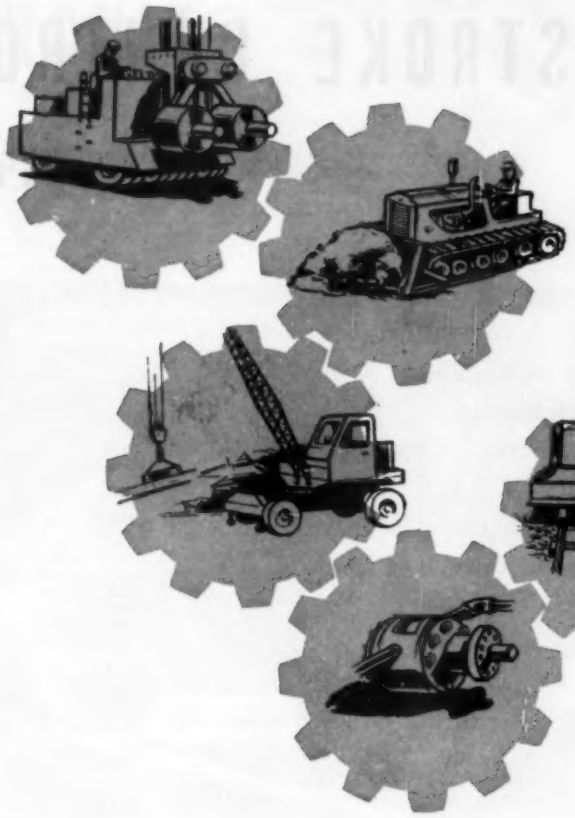


Hydraulic Design in Mobile Equipment

THERE are some design factors and problems which are unique to the mobile equipment field. Pumps are usually driven from a power take-off at the machine engine. This permits easy control of pump speed and usually requires a face flange mounting. Valves are almost always manually operated, and they are designed with several directional control plungers in one housing. Hydraulically powered devices which move in relation to each other are very common and consequently mobile equipment designers use a great amount of flexible hose. Much mobile equipment is operated where service and maintenance facilities are not easily available. This requires rugged, heavy duty equipment on which service does not require a high degree of skill.

Over the years, APPLIED HYDRAULICS has published many articles about hydraulic components and systems for mobile machinery. And during 1956, many new ideas, such as servo controlled lift trucks and hydrostatic transmissions may get the "green light".

In this issue, the engineering of circuits and components for specific mobile applications are detailed. In each of the articles, there's a design idea which may be of value to you.

APPLIED HYDRAULICS

CIRCUIT DESIGN ARTICLE

PUMP STROKE CONTROL

. . . for

One way to regulate the acceleration and deceleration of a heavy load driven by a hydrostatic transmission is to provide automatic adjustment of pump delivery. Although the transmission described in this article is shown being used in coal mining, it has wide application in many industries where an adjustable speed drive is needed. A special servo system is used. The complete cycle is electrically controlled for automatic operation.

• By R. Rowson

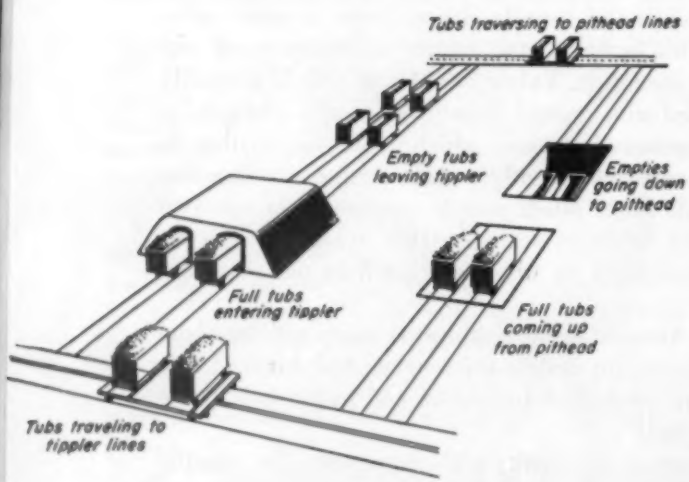

Tubs traversing to pithead lines
Empty tubs leaving tippler
Empties going down to pithead
Full tubs entering tippler
Full tubs coming up from pithead
Tubs traveling to tippler lines

FIG. 1. LAYOUT in a mining operation shows the movement of full and empty tubs which can be easily powered hydraulically.

ACCELERATION and deceleration speeds of hydraulically driven tubs in a coal mining operation are controlled by varying pump delivery to the drive motor. The drive circuit, powering traversers designed by Plowright Bros. Ltd., Chesterfield, England, uses a fixed displacement motor driven by a variable displacement pump. The fluid motor feeds power through a gear box to a chain which traverses empty and full tubs of coal.

Figure 1 shows the job performed by the electrically controlled hydraulic traverser drive. The pit layout shown here has two parallel shafts, one used to raise tubs full of coal, and the other used to lower empty tubs. Full tubs must be traversed to the tippler where they are rolled back over to be emptied. Empty tubs must be moved back to the pit shaft. The traversers carry the tubs in a direction at right angles to that of the tracks which go through the pithead and through the tippler.

With the positive hydraulic variable speed transmission to drive the traverser, very low creep speeds are obtainable. This makes it possible to inch the traverser into exact alignment with the tracks.

A typical velocity vs time or distance graph for a traverser is shown in Figure 3. Traversers have been built to meet a number of different velocity

B. ROWSON, *manager, Hydraulic Engineering Sales Dept., Vickers-Armstrongs Ltd., London, England.*

CIRCUIT

a variable speed transmission

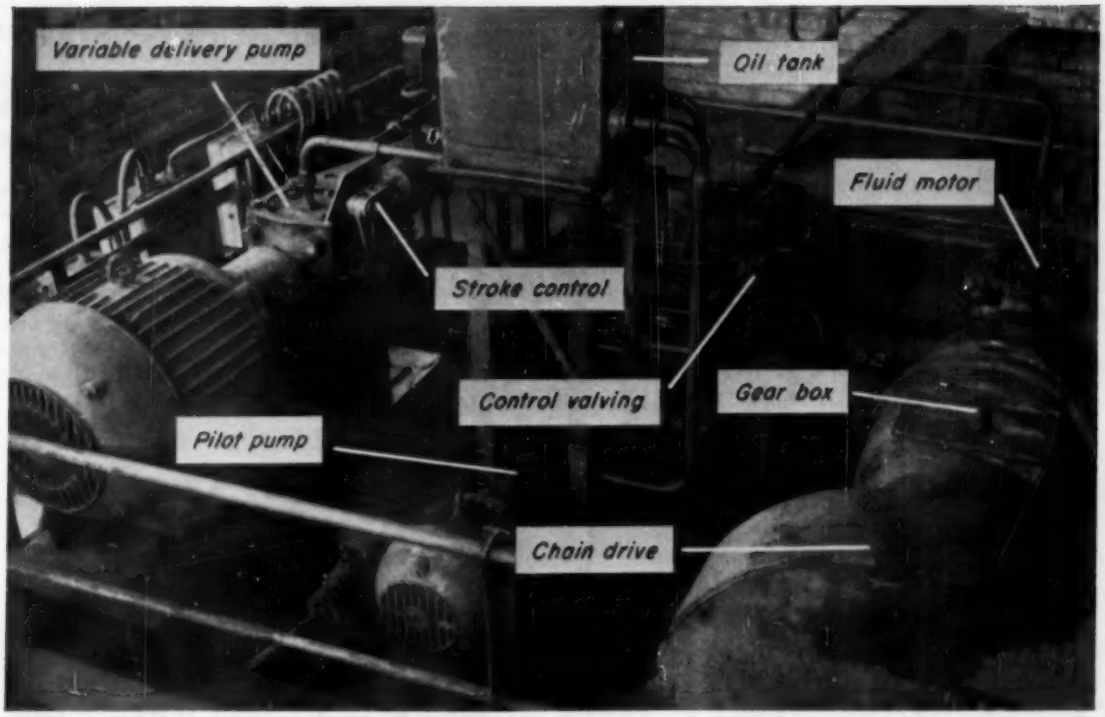


FIG. 2. COMPLETE oil hydraulic drive and control components are shown. The pilot pump powers the stroke control on the variable delivery pump. Photos and data courtesy Vickers-Armstrongs, Ltd.

vs time requirements. Usually, maximum velocity is 170 fpm and creep velocity is 10 fpm. Creep time is usually 1 second.

Variable speed of the fluid motor is governed by the displacement of the pump. The pump used on this drive is an axial piston unit, designed so that the stroke of the pistons can be varied by a force acting on a lever at the side of the pump housing. There are various means of supplying this control force—manual handwheel, electric motor, hydraulic servo control. On this traverser drive, the special pump stroke control system shown in Figure 4 was devised.

ELECTRICALLY INTERLOCKED CONTROL

Power for the pump control cylinder is supplied by a circuit which is electrically interlocked with the traverser drive circuit, Figure 7. The small fixed displacement pump which supplies the control cylinder also supplies oil to pilot operate the

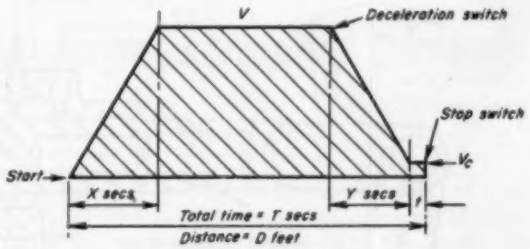


FIG. 3. TYPICAL SPEED vs time graph for a traverser. V = maximum velocity, V_c = creep speed, T = total time of traverse, t = creep time, X = acceleration time to V, Y = deceleration time to V_c, D = traverse distance. When acceleration and deceleration rates are equal:

$$D = \frac{VX}{2} + V(T-t-X-Y) + Y\left(\frac{V+V_c}{2}\right) + tV_c$$

PUMP STROKE CONTROL

main directional control valve to the fluid motor.

Speed adjustment depends on the stroke control cylinder. Here's how it works. As shown in the circuit drawing, Figure 4, area A is under pressure (180 psi) at all times and area C is open to tank at all times. When the traverser is standing still, all valves are deenergized and constant pressure acts on area A,B, and D. The control lever is held in neutral or no speed position, because pressure on area B creates a force which overpowers the force developed on area A.

To start the traverser forward, a pushbutton is depressed which energizes the forward solenoid of the directional control valve between the variable delivery pump and rotary fluid motor. A time delay switch provides a one second interval between the energizing of the forward solenoid and solenoid valves A and C. Areas B and D are now open to tank so that pressure on area A causes movement of the control arm. Oil from area D is metered to tank through throttle valve 3. This valve controls acceleration of the moving tubs by regulating the time it takes for the pump delivery to increase from zero to full. After the control arm has shifted to full speed, the moving tubs traverse at maximum velocity.

After the traverser has moved the required distance, a limit switch is tripped to deenergize valve C and energize valve B. Oil now flows through valve B, throttle valve 2, valve C and acts on area D. This causes motion of the stroke control piston and control arm toward the creep position. Rate of movement, or deceleration time is determined by throttle valve 2.

When the control arm reaches creep speed, it stops moving so that the delivery from the variable delivery pump to the rotary fluid motor remains at a small constant value during time interval "t" as shown in the graph, Figure 3. The point at which the piston in the stroke control cylinder stops can be set by the creep speed adjustment screw. To stop the traverser when it has moved into alignment with the tracks, a stop switch is tripped. This action deenergizes solenoid valve A. Oil pressure immediately directed against area B snaps

Continued on page 70

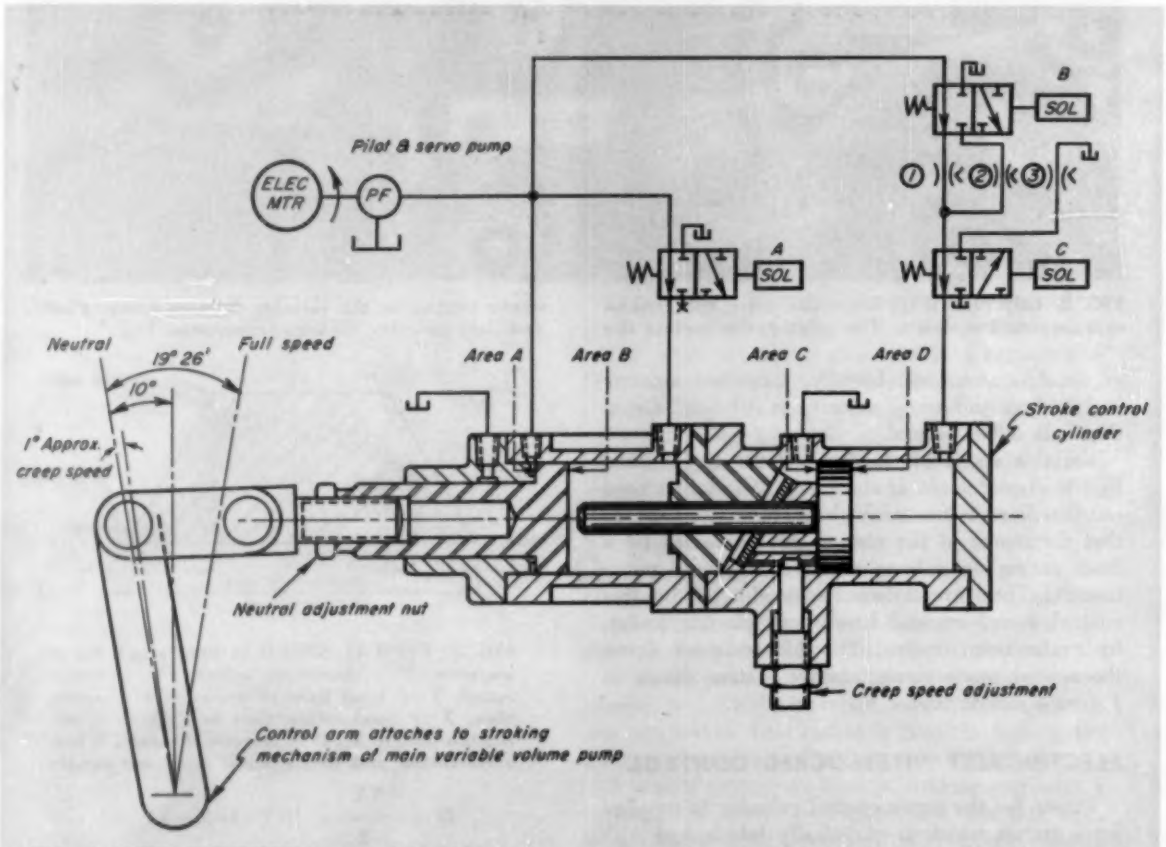


FIG. 4. PUMP DELIVERY is varied by this stroke control circuit. Adjustment of acceleration, deceleration and creep can be made to meet a wide range of requirements.

FIG. 1. GIANT STRIPPING shovel has electro-hydraulic system for leveling and for equalizing the load at each of the four corners.

A new circuit for an old application—modern electrically controlled hydraulic circuit replaces manual system developed back in 1910. What has been gained? The new circuit provides . . .

AUTOMATIC LEVELING AND LOAD EQUALIZING

on large stripping shovels

• By J. F. Weis

STRIP or open pit mining—the removal of coal or other minerals such as iron and copper ores which are close to the surface of the ground—makes use of giant power shovels. Today, these shovels are built with dippers which can handle as much as 60 cubic yards. A 45 cubic yard shovel, built by Marion Power Shovel Company is shown in Figure 1.

Except for their small capacity of 3 to 3-½ cubic yards, the stripping machines built in the early 1900's were much the same as today. To solve the problem of stability, four widespread propelling units, one under each corner of a wide lower frame were used. However, without any provision for leveling and equalizing loads when the machine moved over uneven ground or was digging when on an incline, tremendous stresses caused numerous structural failures.

After several mechanical methods were attempted to properly distribute loads,

J. F. WEIS, *chief electrical engineer, Marion Power Shovel Company, Marion, Ohio.*
Design of this hydraulic system was carried out with The Denison Engineering Company, Columbus, Ohio

a hydraulic system was introduced in 1910. Of course, as shovel capacities became greater the leveling system took on greater importance.

Figure 3 illustrates the original hydraulic leveling and equalizing system which has been used with little change on shovels built up until a few years ago. Leveling and equalizing with the original system is accomplished by opening and closing hand valves. During shovel travel between digging stations, an equalizing valve is opened to permit oil flow between the two front cylinders to give the effect of a three point support. By doing this, the load is equalized as the machine moves over uneven ground. At a new digging position, the machine must be leveled. Leveling is accomplished by opening hand valves so that oil is forced from the high corner to the diagonally opposite low corner. This is repeated over the opposite diagonal until the machine is level.

. . . the user wants a leveling system which will not affect production . . . he wants the machine to level as it travels . . .

The old circuit uses a reciprocating plunger pump. Some of the first pumps were steam driven. The pump is used to pump oil into the cylinders to raise the machine so that the pistons extend about one-half their total length. If there is any leakage at the jacks, the pump serves to replace the lost oil. An auxiliary hand pump is also in the circuit to be used if the power operated pump fails.

This old system does the job of equalizing and leveling. But it does it very slowly. With the development of large modern machines, costing $1,000,000 or more, operating costs are formidable. The shovel user wants a high output. With the old circuit, no production is obtained while leveling. Therefore, a new hydraulic system using automatic electrical control of the leveling and equalizing valves was engineered.

ELECTRICAL SENSING SYSTEM

The automatic leveling equipment consists of a hydraulic system of two pumps and electrically operated solenoid valves that pumps oil into the cylinder to raise the corners that are low and permits oil to flow out of the cylinders to lower the corners that are high. An electrical control system of level sensitive switches, contactors, and control station selects the high and low corners, automatically starts the pumps and opens the proper solenoid valves for leveling the machine. The control station is arranged so that the ground man can raise or lower all four corners when desired. A solenoid operated equalizing valve is connected in the hydraulic system so the machine is equalized whenever it is propelled.

Leveling is accomplished by working on diagonally opposite corners, raising one and lowering the other, so there are two sets of pumps and controls, one for each diagonal pair of corners. The solenoid valves for each pair of cylinders are mounted on a control panel arranged so all these electrically operated valves may be readily removed for inspection or repair without shutting down the machine.

Limit switches on each cylinder stop the axial piston type pumps when the allowable travel has been reached and light a red warning light if any corner i too high or too low.

Metering valves, on the control panels, control

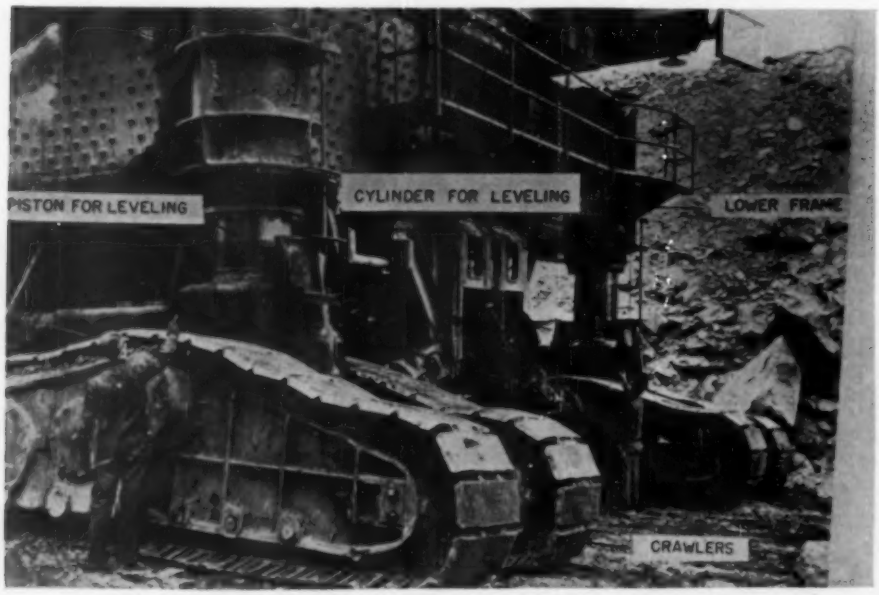


FIG. 2. LEVELING PISTON and cylinder is mounted at each of the four corners. This hydraulic technique has been used since 1910 on strip mining shovels.

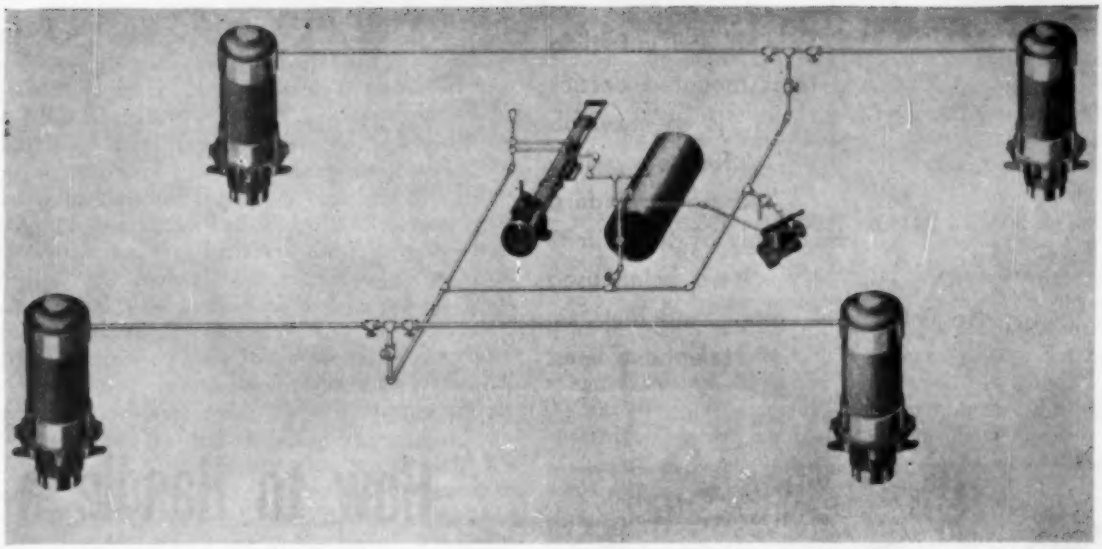


FIG. 3. ORIGINAL HYDRAULIC system is manually controlled, uses a reciprocating plunger pump, and has a hand pump to be used in case of power failure.

the volume of oil let out of the high corner cylinders to make certain that the same amount of oil goes out as is pumped into the diagonally opposite cylinder. This is set by adjusting the metering valves so that the average height of the extended pistons remains the same over a number of leveling operations. Hand operated valves permit removal of the devices without shutting the machine down. They also permit hand leveling in case of valve or pump failures.

SWINGING PENDULUM TRIPS SWITCH

Two simple pendulum type leveling devices are used. They are located to swing parallel with the diagonals of the lower frame. If the lower frame is not level along a diagonal, the pendulum swings to calculate a switch that starts the proper pump and opens the correct valves to pump oil into the low corner and allow oil to escape from the high corner. The upper frame of the machine can be in any position while leveling because the pump exerts sufficient pressure to raise any corner of the machine regardless of the distribution of the weight. The machine actually levels itself while digging should it become out of level for one reason or another.

Unless there is a great variation in the surface on which the machine travels, no time is lost when the machine moves up to a new position since leveling can be accomplished as the machine moves ahead. If there should be large dip or rise, it might be necessary to wait awhile for leveling to take place. When the machine is level, the operator receives a signal and he is ready to start digging again.

The leveling and equalizing system as used today has proved time saving and low in maintenance. It has made it possible to build larger shovels and obtain greater production than otherwise would be practical. The pumps and hydraulic valves that are used give very little difficulty with ordinary care and maintenance and thus contribute to the records of performance and reliability which these large shovels have attained. ▼▼▼

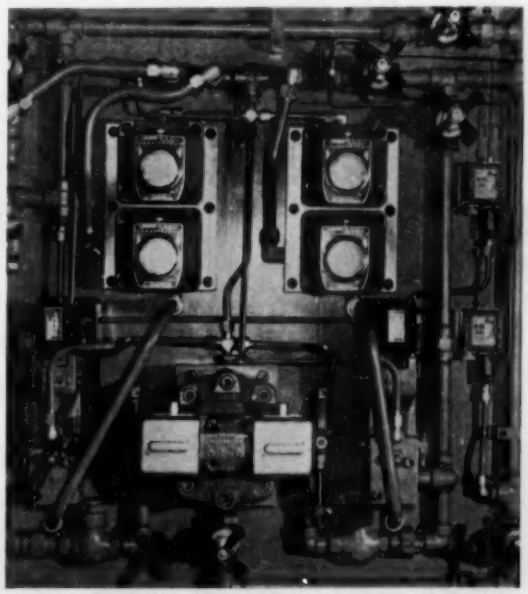
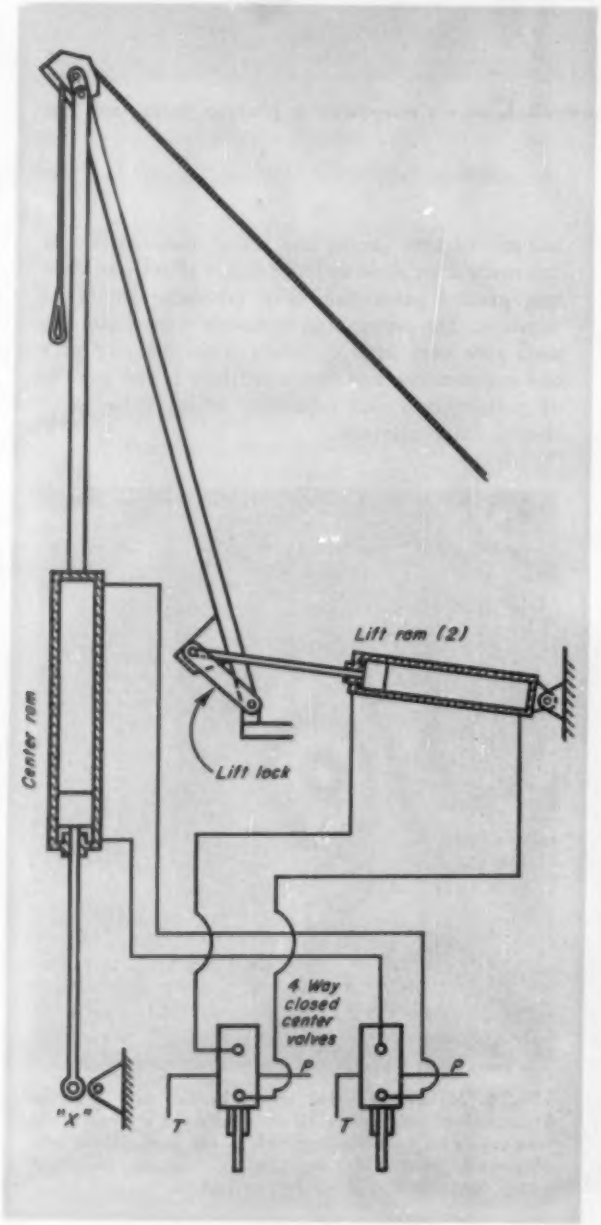


FIG. 4. MODERN valve panel in the new electro-hydraulic circuit holds all the solenoid operated directional and flow control valves for controlling two diagonally located leveling pistons. A second identical panel controls the other two cylinders.

Folding and unfolding
a truck mounted derrick
is an easy job
for heavy duty
hydraulic cylinders.
Hundreds of these units
are being used
to help install, repair and maintain
telephone lines.



How to Handle a Truck Mounted Crane

• By Jan M. Garvin

BUNDLING up a truck mounted derrick to take it out to the job and then unbundling and setting it up to do the job can be a major problem to utility companies. With telephone and power lines strung all over the country, maintenance is a big job. Routine, as well as emergency repairs have to be done fast.

The large amount of repair and maintenance of utility lines has created a need for versatile vehicles, which aside from providing transportation for the crew and equipment must perform a variety of jobs connected with erection and replacement of aerial plant.

These vehicles are equipped with derricks or cranes, which handle the poles and provide adjustable support for earth drilling equipment, which dig holes for the poles. The

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JAN M. GARVIN, *vice president, Machinery & Machine Supplies Company Inc., New York City*

whole rig must be collapsible, so that it can be easily transported over the road, and it should be possible to set up for work with minimum of fuss and loss of time.

It is on these derricks, designed by one of the major telephone companies, that the use of fluid power has resulted in greater economy and efficiency of operation. Before hydraulics was used for actuating the derricks, these devices were erected and folded by mechanical means. This method was time consuming and lacked the flexibility of hydraulic controls.

The hydraulic circuit sketch shows the simplicity of the present arrangement, which uses two lift cylinders and one main cylinder. During transit between jobs, the derrick is folded on top of the truck. At the work site, unfolding is started by directed oil to extend the pistons of the two lift cylinders. As the pistons extend, the derrick unfolds upward and out in front of the truck. When the derrick is moved out to a point where the extended piston of the main cylinder can be connected to the derrick supporting bracket at "X", travel of the lift cylinders is stopped by means of the lift lock. The derrick is now in position for use. It rests on the fluid support of the main cylinder which serves as a part of the derrick column. This main cylinder which now becomes a structural member has a heavy wall steel barrel, steel end caps and a husky piston rod to provide rigidity to the whole assembly. By extending and retracting the main cylinder piston, the operator controls the height of the derrick.

To fold up the derrick after use, the operator must first unpin the main cylinder at point "X". Retraction of the lift cylinders then folds the derrick back onto the truck. Two men can handle the setup in a few minutes.

FLUID MOTOR DRIVES EARTH AUGER

When the derrick is setup for digging holes for poles, a hydraulic motor with earth auger is suspended from the derrick cable and connected to the hydraulic power unit by flexible hose. Here again, the use of fluid power results in greater efficiency and economy—the operation is much smoother, when compared to the previous mechanical coupling to the truck engine power take-off. The hydraulic motor provides a sure and smooth overload protection through a relief valve in the circuit. This is a valuable advantage, when unexpected obstacles in the ground can block the earth digging auger and damage it or the drilling mechanism. Previously protection was provided by conventional use of shear pins with resulting in inconvenience and time loss, when it had to be replaced.

To obtain maximum safety in the operation of the derrick, the push stroke port of the main cylinder is just big enough for the necessary operating speed. The throttling effect of the small port prevents sudden collapse of the rig in case of line failure or other mishap. ▼▼▼

BECAUSE HYDRAULIC power is used, it only takes a few minutes to fold this derrick onto the top of the truck ready to move to another job. *Circuit data courtesy Hydro-Line Manufacturing Co.*

Many of the design problems common to other hydraulic equipment are accented in industrial truck systems. Smooth, metering operation of valves is necessary to prevent momentary dropping of the load when transferring from hold to lift. Small clearance between plunger and bore is required to prevent downward drift while holding load. Counterbalancing devices are necessary to prevent cavitation of the tilt cylinders which are subject to negative loads. Higher pressures bring problems of axial balancing of plungers, accurate machining and alignment of the plunger, and higher pressure drops across the valve.

CONTROL VALVE DESIGN

. . . for industrial lift trucks

FIG. 1. HYDRAULIC SYSTEM permits safe, flexible control of lifting, lowering, tilting, and clamping on industrial lift trucks.

• By E. J. Hrdlicka

EARLY industrial lift trucks employed electrical or mechanical systems for the basic motions of lifting, lowering, tilting, and other operations. Mechanical systems proved to be extremely complicated, and electrical systems were costly and bulky. The use of hydraulic power provides simplicity and low cost with relatively compact units providing ample power. Most important, hydraulic power transmission provides accurate operator control for the four lift trucks operations of lifting, lowering, tilting, and clamping.

Features of lifting and lowering control should include:

1. Complete operator control at all times for the safety of the operator and those working near the truck.
2. Smooth raising and lowering of the forks, with and without a load, over long and short distances.
3. An absence of momentary drops when going from a hold position to a raising motion.
4. Rate of lowering with a load not appreciably faster than without a load, and preferably slower with a load than without.

Figure 2 shows a 2-plunger valve with integral relief designed for simplicity in lift truck control. One plunger operates a single acting lift cylinder; the second plunger may be used to operate double acting tilt cylinders. The plunger-type valve can be easily balanced, and throttling or metering features can be readily incorporated. The basic motions for all lift truck valves are: pull out to raise the load, push in to lower the load, and slowly release the handle to stop and hold the load. With a spring-centered valve the operator has no difficulty in finding the neutral or hold position in which the cylinder ports are blocked and the pump is connected through

E. J. HRDLICKA, *general manager, Hydreco Div. New York Air Brake Co., Cleveland, O.*

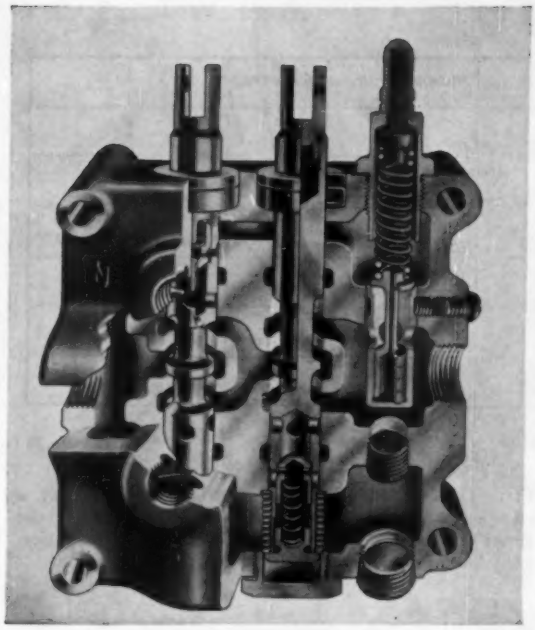


FIG. 2. LIFTING AND LOWERING of load is controlled by one plunger of this valve. Plunger is connected as 3-way, 3-position valve to control the single-acting lift cylinder and to unload the pump. The second plunger operates double acting lift cylinders. A built-in relief is shown.

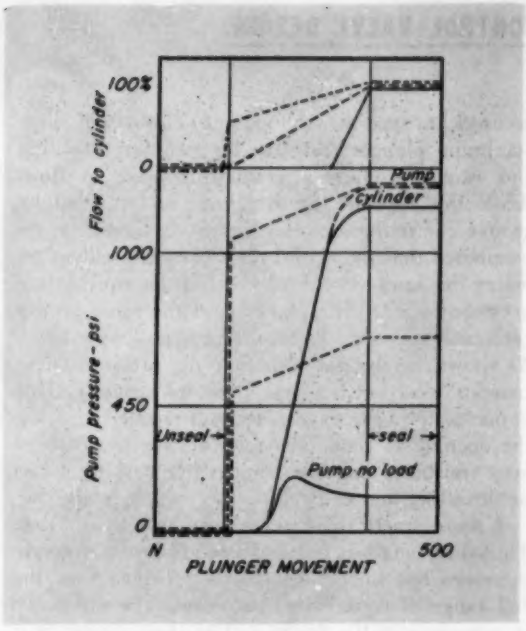


FIG. 3. GRAPH SHOWS flow to lift cylinder and pump pressure as pump output is transferred from tank to cylinder. Ideal transfer is steady increase of flow over longest plunger travel. The dashed line shows the ideal variation in flow and pressure as the valve plunger is moved.

the valve to the tank. When the plunger is pulled out to the limit of its stroke, the tank bypass is blocked and the pump is connected to the cylinder head-end port to lift the load.

To lower the load, the valve plunger is pushed in so that the cylinder head-end port is connected through the valve cored passage to tank and the weight of the load retracts the cylinder. During the lowering operation, the pump is unloaded. Both the "lower" and "neutral" positions allow for pump unloading at no pressure except for that caused by pressure drop through the coring of the valve and the high pressure and return lines. This means that practically no horsepower is required for the hydraulic circuit, except when actual work is being done.

SPOOL DESIGNED TO METER FLOW

To provide operator control for smoothly raising and lowering the forks, metering notches and staggered holes are provided in the valve. To understand the operation of these it is first necessary to examine the problem of timing. If the cylinder is connected to the pump before the pump is cut off from the tank, the load can drop because of the momentary connection of cylinder to tank. If the pump is disconnected from the tank before it is connected to the cylinder, there is no place for the oil to go except through the relief valve. When this occurs, large shocks will result, since the relief valve will not open instaneously. It has been found that the best method of connecting the pump to the cylinder is to time the valve plunger, so that the cylinder is connected to the pump before the pump is cut off from the tank and to prevent cylinder draining with a check valve built into the valve plunger. If the connections from the pump to the cylinder and tank are both instaneously cut off, there will be an instantaneous shift of oil flow causing shocks and jerking motion and resulting in loss of operator control. For this reason a hollow plunger with staggered holes and metering notches is used. The staggered cross holes allow the operator to obtain a gradual increase in the amount of flow from pump to cylinder. The metering grooves allow for a gradual decrease in the flow from pump to tank. The hollow plunger also provides for compact installation of the check valve.

Figure 3 is a graph of plunger movement versus flow to the cylinder and also shows pressure at the pump. We are interested only in smooth control after the system pressure has increased to a point nearly equal to the equilibrium pressure created by the load which in this case is 1000 psi.

Therefore, the ideal curve, as shown by the dash line, would be a rapid increase from zero pressure at the neutral position to the equilibrium or static pressure within the cylinder line. The remainder of the curve would be a straight line of smooth throttling from the equilibrium pressure to that pressure

necessary to start the load moving. This would allow maximum plunger travel to be used for throttling and would produce a gradual increase in flow. While this type of throttling can be provided by groove configurations and timing, it should be remembered that the equilibrium pressure seldom remains the same. If a load creating an equilibrium pressure of 450 psi is raised and the same groove configuration used, the throttling is no longer ideal. As shown by the dot-dash line, the pressure curve remains ideal but the flow increases abruptly. This is due to the fact that we are still rapidly reducing the opening to tank. The oil will take the path of least resistance into the cylinder line causing a loss of throttling and control.

A more practical curve is shown by the solid line. Throttling length is reduced as equilibrium pressure increases but smooth control is provided over the full range of equilibrium pressures. The difference in pressures at the pump and at the cylinder port represents the pressure drop through the valve and hoses. As the flow to the cylinder increases the pressure drop increases.

VALVE CLEARANCES

To prevent downward drift while holding a load it is necessary to provide a minimum of clearance between the plunger and the bore. At the present time tolerances between .00015 and .0005 provide a minimum of drift and still eliminate plunger binding and sticking. On many designs annular grooves are machined on the lands of the plunger to provide equal pressure on all sides and to prevent it from binding against one side of the bore. Since it is a near impossibility to provide equal clearance on all sides of the plunger within the bore, it would be possible to develop high pressure areas on surfaces of the plunger if the grooves were not provided.

It has also been said that such grooves help to prevent leakage, but it is more probable that the leakage is actually prevented by accumulations of dirt particles and bits of packing from the other parts of the system which collect in the grooves. A more plausible explanation of why the grooves prevent leakage is again due to their primary purpose of balancing the plunger. If the plunger is unbalanced and is forced in one direction against the plunger bore, the clearance is concentrated on one side, providing a larger area for leakage.

Figure 4 is a graph of leakage rate versus clearance, and it will be noted that leakage rate is not proportional to the annular clearance area but that the rate increases rather sharply at .0003 inches clearance. This is a further indication of why it is sometimes important to produce plunger balance with grooves. In the hollow-plunger type valve, grooves for balancing are not used since the staggered cross holes provide the same pressure equalization feature. The areas remaining for possible unbalance are not sufficiently large to allow the plungers to stick.

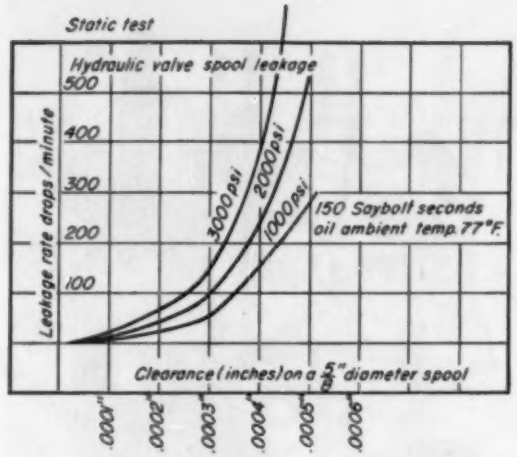


FIG. 4. VALVE LEAKAGE increases sharply at a clearance of .0003 inches. Annular grooves in the spool lands keep spool aligned in bore and help prevent leakage. Courtesy Yale and Towne Mfg. Co.

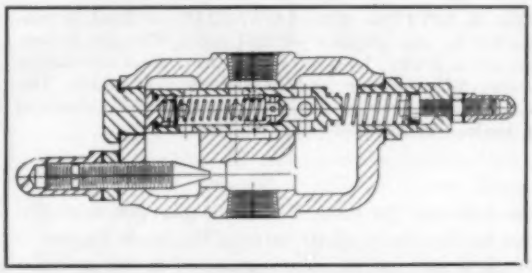


FIG. 5. CONSTANT LOWERING SPEED regardless of load weight is accomplished by this pressure-compensated valve which has a metering plunger maintaining a fixed pressure across the orifice.

The problem of controlled lowering has frequently been solved by means of various valves not incorporated into the main directional-control valve body. The simplest means of providing controlled lowering is by using a check valve with a drilled hole. Such a valve allows free flow in one direction for lifting and an orifice restriction for flow in the opposite direction while lowering. The disadvantage of this type of control is that the rate of lowering varies with the size of the load. Also, the rate changes with the viscosity of the oil.

A more common control is the valve shown in Figure 5. This is a pressure-compensated flow control valve which allows the load to move down at a fixed rate regardless of its weight. This is accomplished by means of a metering plunger which mon-

Continued on page 72

• By Russell W. Henke

INTERNAL LEAKAGE ... in gear pumps

To both the user and designer of gear pumps, it is important to understand why and where there is internal leakage. Since a pump is used to develop pressure and deliver a rated volume of oil, its performance largely depends on the amount of internal leakage.

IF we assume that pump materials and bearings are properly selected and that operation is maintained with the proper oil at the correct temperature and never above maximum rated pressure, internal leakage then depends on manufacturing tolerances. Selection of the machining tolerances usually requires a compromise between attainable product performance and cost of production. It is essential that the designer specify the maximum tolerances and clearances commensurate with *proper operation* of the product.

What are the maximum tolerances for proper operation? To determine these tolerances, the designer must study each of the possible leakage paths and evaluate the effect of each path on overall performance.

Obviously, it is impossible to manufacture, assemble and operate a gear type pump, on a production basis, with zero clearances and no dimensional tolerances. To the user, this means that the theoretical output is never attainable. "Slippage" will be present, making it necessary to accept some volumetric efficiency in the range of 80 to 95 percent.

The amount of clearance at three leakage paths largely determine the pump's efficiency:

1. radial clearance,
2. end face clearance,
3. tooth contact.

RADIAL CLEARANCE

In order for the gears to be free to rotate within the pump housing, there must be a clearance between the outside diameter of the gear and the bore of the pump housing. This opens up a leakage path for slip oil to move from pressure to suction side of the pump through the annular space bounded by the gear housing bore on the outside and the gear outside diameter on the inside.

RUSSELL W. HENKE, *Chief Mechanical Engineer, Research & Development Div., Badger Meter Mfg. Company, Milwaukee, Wisconsin*

GEAR PUMP LEAKAGE

Figure 1 shows the nature of the pressure distribution around the periphery of the gear in a gear type hydraulic pump. The pressure varies according to the relation: $P = P_{max} \frac{\alpha}{\pi}$

The pressure is constant for all practical purposes in quadrant IV containing the pressure outlet port, and gradually builds up to this maximum value from the suction side. This pressure distribution results in a pressure differential from pressure to suction side of the gear. When the pressure differential is of sufficient magnitude to overcome the friction resistance of fluid passage through the existing gap, flow will ensue. Since gear type pumps usually run at pressures, there is generally a sufficient pressure differential to produce fluid flow, and the gap exists due to design clearances in the pump.

An analysis of fluid flow in the radial clearance gap results in the equation:

$$Q = W\left[\frac{3.132 \times 10^6 (P_1 - P_2)\delta^3}{V L} - 3605\delta\right] \quad \text{.....I}$$

Q = slippage, cubic inches/min

$P_1 - P_2$ = pressure differential between discharge and suction, psi

δ = clearance between gear and pump housing, inches

V = Kinematic viscosity of the fluid

L = length of the flow path, inches

W = width of flow path, inches

S = speed of the gear in inches per minute

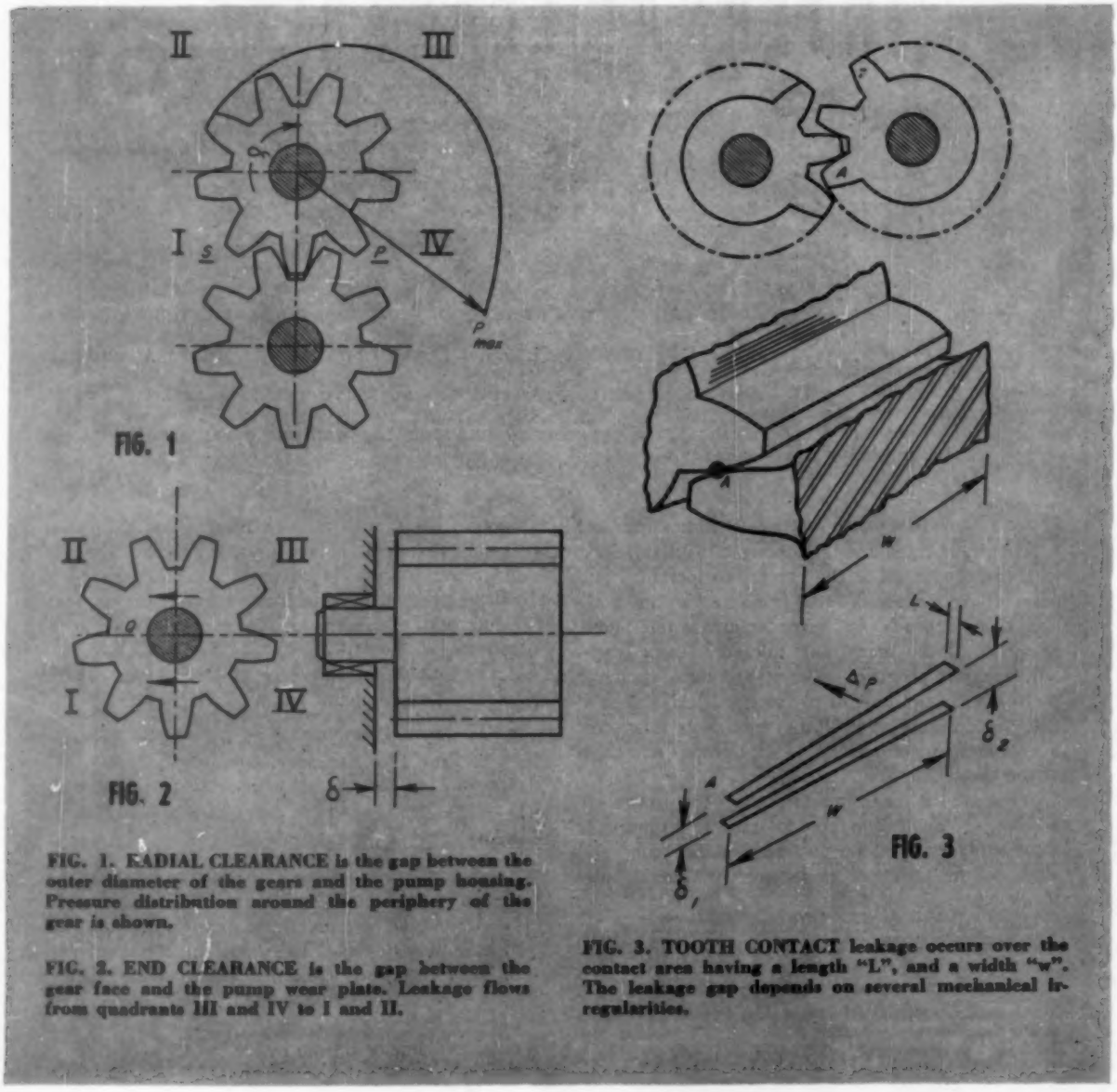


FIG. 1. RADIAL CLEARANCE is the gap between the outer diameter of the gears and the pump housing. Pressure distribution around the periphery of the gear is shown.

FIG. 2. END CLEARANCE is the gap between the gear face and the pump wear plate. Leakage flows from quadrants III and IV to I and II.

FIG. 3. TOOTH CONTACT leakage occurs over the contact area having a length "L", and a width "w". The leakage gap depends on several mechanical irregularities.

Experience has indicated that the length of the flow path, L, is about ¾D where D is the outside diameter of the gear.

Equation 1 permits the calculation of theoretical values of leakage through radial clearance.

END FACE CLEARANCE

There must be clearance between the end faces of the gear and the wear plates or thrust surfaces of the pump housing. If adequate clearance is not provided, the gears will "seize" the wear plate due to friction heat generated by the rotation of the gear against the static wear plate. This clearance provides a second leakage path from pressure to suction side of the gear through the space between the gear face and the wear plate of the pump housing.

A secondary leakage path through the bearings depends on the end face leakage to deliver oil to the bearings.

It has been found necessary to relieve the bearing leakage oil to the suction side of the pump to avoid pressure buildup in the bearings. This relief path is the bearing leakage path.

An analysis is made which is similar to that made for the radial clearance—based on capillary flow between two parallel plates with a moving boundary. Figure 2 shows that the end face leakage gap is a ring, since the gear shafts are interposed in the centers of the gear faces.

Half the area of the rotating gear tends to oppose flow of fluid through the leakage gap, while the other half tends to aid flow. The highest pressure in the pump, the discharge pressure, is considered constant throughout the last quadrant of gear rotation. It is in this quadrant that the motion of the moving boundary aids fluid flow.

There is less leakage from the third to the second quadrant than from the fourth to the first because pressure in the third quadrant is less than pressure in the fourth, and also motion of the gear retards flow from the third to the second quadrant.

To perform the mathematical analysis, the concept of equivalent rectangle is introduced such that the length of the rectangle equals ½ the mean circumference between the shaft and the gear O.D.; and width equals the difference between the radius of the shaft and the radius of the gear. This results in the flow equation:

$$Q = (R_g - r_s)\left[\frac{6.264 \times 10^6 (P_1 - P_2)\,\delta^3}{\pi V (R_g - r_s)} + 360S\delta\right] \quad \text{.....2}$$

R_g = radius to the outside of the gear, inches

r_s = radius of shaft, inches

Equation 2 gives the theoretical leakage flow through the gap at the end faces.

TOOTH CONTACT LEAKAGE

One of the assumptions in the design of gear type pumps is that the line of contact between driving and driven gear teeth forms a seal which prevents passage of liquid under pressure from the discharge to the suction side of the pump. This is difficult to attain in practice because of runout between gears, surface imperfections, non-parallelism between shafts, and similar manufacturing imperfections.

The line of contact of two meshing gear teeth is labeled "A" in Figure 3. This "contact area" is shown as being of length "L" and width "W".

The gap, δ, is the average of the end gaps illustrated, δ_1 and δ_2. Perhaps the best means of determining δ is to actually measure sample pumps until a backlog of information is obtained; or make assumptions of the value of δ based on past experience and knowledge of gear and pump design.

Analysis of leakage at the tooth contact area results in equation:

$$Q = W\left[\frac{3.132 \times 10^6 (P_1 - P_2)\delta^3}{VL}\right] \quad \text{.....3}$$

Theoretical leakage or slippage in a gear pump can be calculated by using equations 1, 2 and 3. Equation 2 gives the leakage past only one of the four gear end faces in a pump. Also, equation 1 gives radial leakage past only one gear.

Leakages can be calculated for various clearances and subtracted from the theoretical displacement of the pump to obtain an idea of the order of pump efficiency which can be expected.

The theoretical displacement of a gear pump can be determined from the following relationship:

$$D = \frac{\pi}{4}(D^2 - d^2)\,LN \quad \text{.....4}$$

D = outside diameter of gear

d = root diameter of gear

L = length of gear

N = pump speed, rpm

PRACTICAL APPLICATION AND RESULTS

A series of tests were run, using the development just described as a basis for experimentation. A test unit was devised in which an attempt was made to isolate each leakage path. The radial clearance leakage gap was varied by making up pairs of gears with various outside diameters while the housing bore remained constant. The end face clearance was varied by using movable wear plates at one end of the gears and fixing their position relative to the ends of the gears by means of micrometer screw adjustments.

Control of the tooth contact gap is difficult. An attempt at correlation to actual conditions was made by calculating the torque input to the pump at different pressures as related to the displacement of the pump and then loading the shafts with these torque values. Thus the leakage across the gear teeth could be measured as a function of pressure. This did not bring the line of contact gap into the picture quantitatively, but it did correlate the gap

with the various tooth pressures encountered at different discharge pressures.

From these tests, curves in Figure 4 were determined. Figure 4 shows total pump slippage which can be charged to each of the leakage paths for a given clearance. The line of contact leakage theoretically contributes greatly to the total leakage in pumps built to close tolerances and clearances. The percentage of total leakage for each clearance remained practically constant over the entire pressure range for which calculations were made.

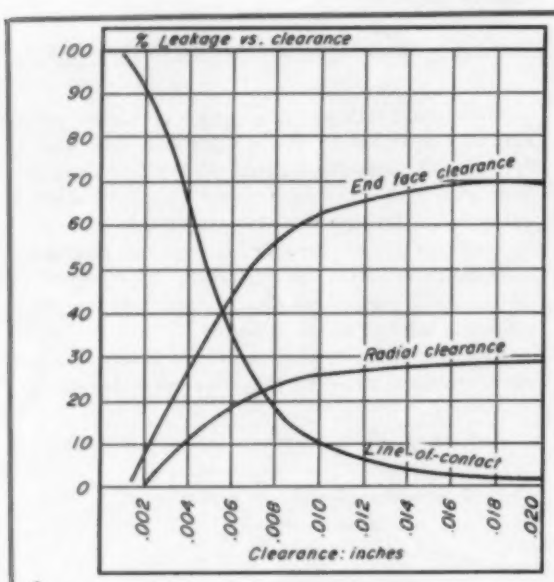
An attempt to illustrate qualitatively the efforts of the clearance leakage paths on the efficiency of a gear pump is shown in Figures 5 and 6. These curves show pump efficiency platted against radial clearance and end face clearance, while other clearances were held to a constant minimum.

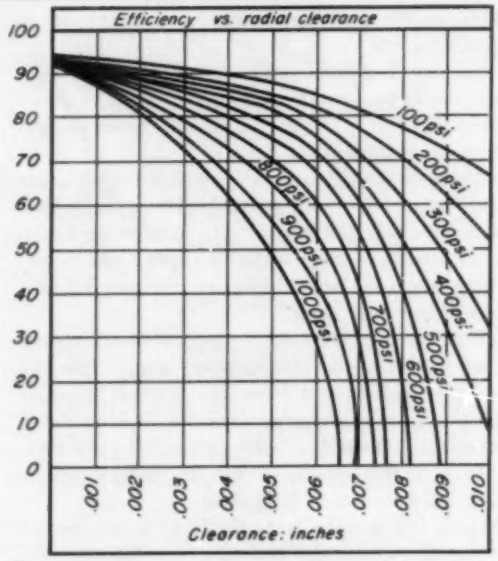
Based on the theoretical development and subsequent tests, these conclusions are made:

1. Line of contact leakage is important in precision pumps where radial and end face clearances are held to a minimum. Therefore, factors such as run-out, shaft parallelism, tooth parallelism, and surface conditions, assume increasing importance.

2. Test results indicate that end face clearance contributes substantially more to leakage than radial clearances of equal magnitude.

3. As shown by the efficiency vs. clearance curves, the higher the pressure at which a given size pump is to operate, the closer must be the clearances to maintain good pump efficiency.▼▼▼





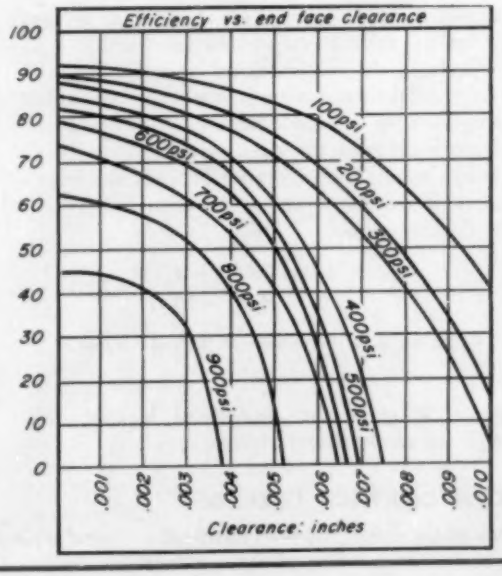


FIG. 4. TEST RESULTS show the percent of total pump slippage which can be charged to each of the leakage paths for a given clearance.

FIG. 5. EFFECT OF RADIAL CLEARANCE on pump efficiency for various operating pressures.

FIG. 6. END FACE clearance is a major factor in determining pump efficiency.

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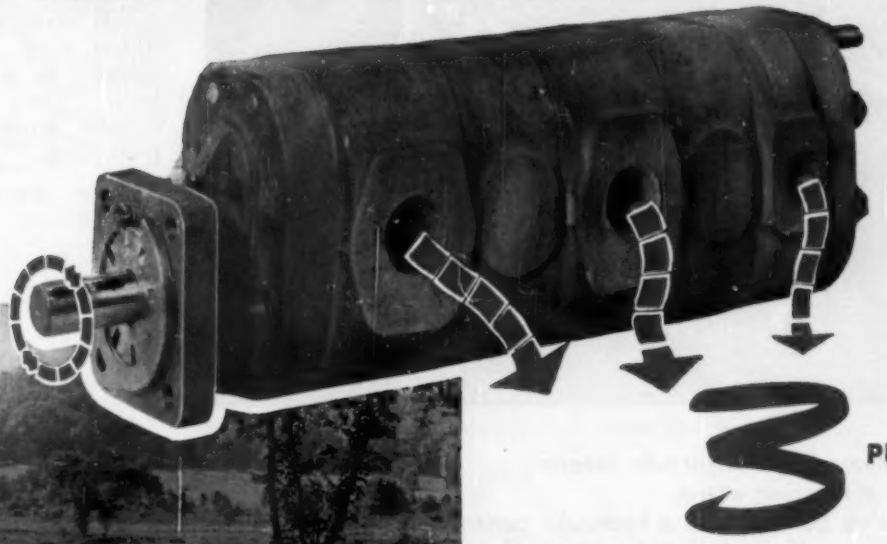
with HYDRAULIC PERFORMANCE



3 PUMPS

deliver independently

This heavy-duty "Commercial" triple hydraulic pump generates fluid power in abundance to operate the tools of the multi-functional Gradall. No other kind of power transmission could successfully furnish power required to dig tough materials like shale; at the same time furnishing smooth precision-controlled down pressure on the tool, a feature inherent in this multi-purpose machine.

Three separate fluid power pumps are assembled into a single unit, all driven by one through shaft to which the primary driving power is applied. It is not unusual for these pumps to operate at pressures up to 1200 psi. Total discharge of about 95 gpm at 1500 rpm could be developed, with the first and second pumps each delivering 40 gpm to power the cylinders actuating the boom and the third pump supplying about 15 gpm to the cylinder which positions the tool.

"Commercial" gear type fluid power pumps are heavy-duty—designed and built for one main objective: troublefree service over a long life expectancy. Many original equipment manufacturers today are using "Commercial" pumps because they perform better, require less servicing, and have proven that they save money. The Commercial Shearing and Stamping Company, Youngstown, Ohio; Chicago, Illinois; Salt Lake City, Utah.

Gradall's smooth power enables it to accurately grade ditches for drainage.

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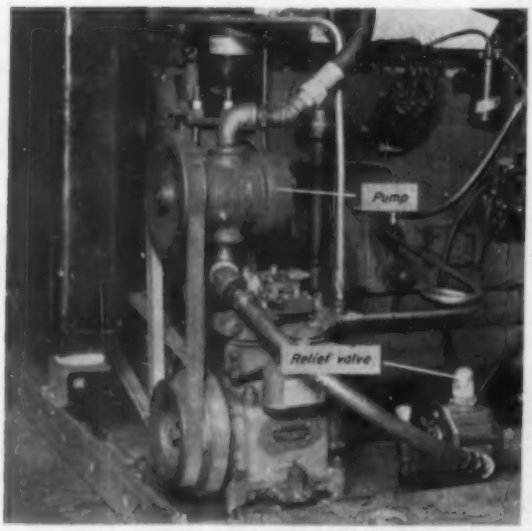
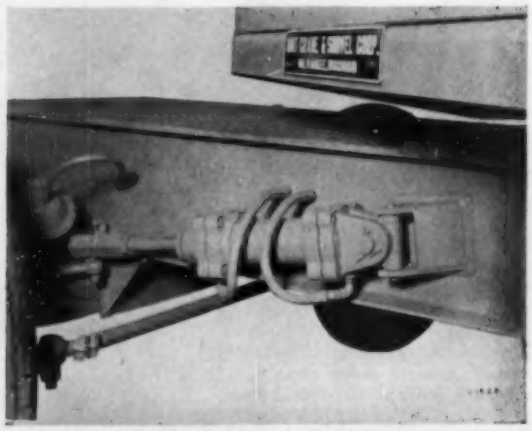
between the rotating top assembly
and the stationary wheel frame.
This problem was solved
at Unit Crane & Shovel Corp. where
engineers designed a . . .

. . . ROTATING MANIFOLD

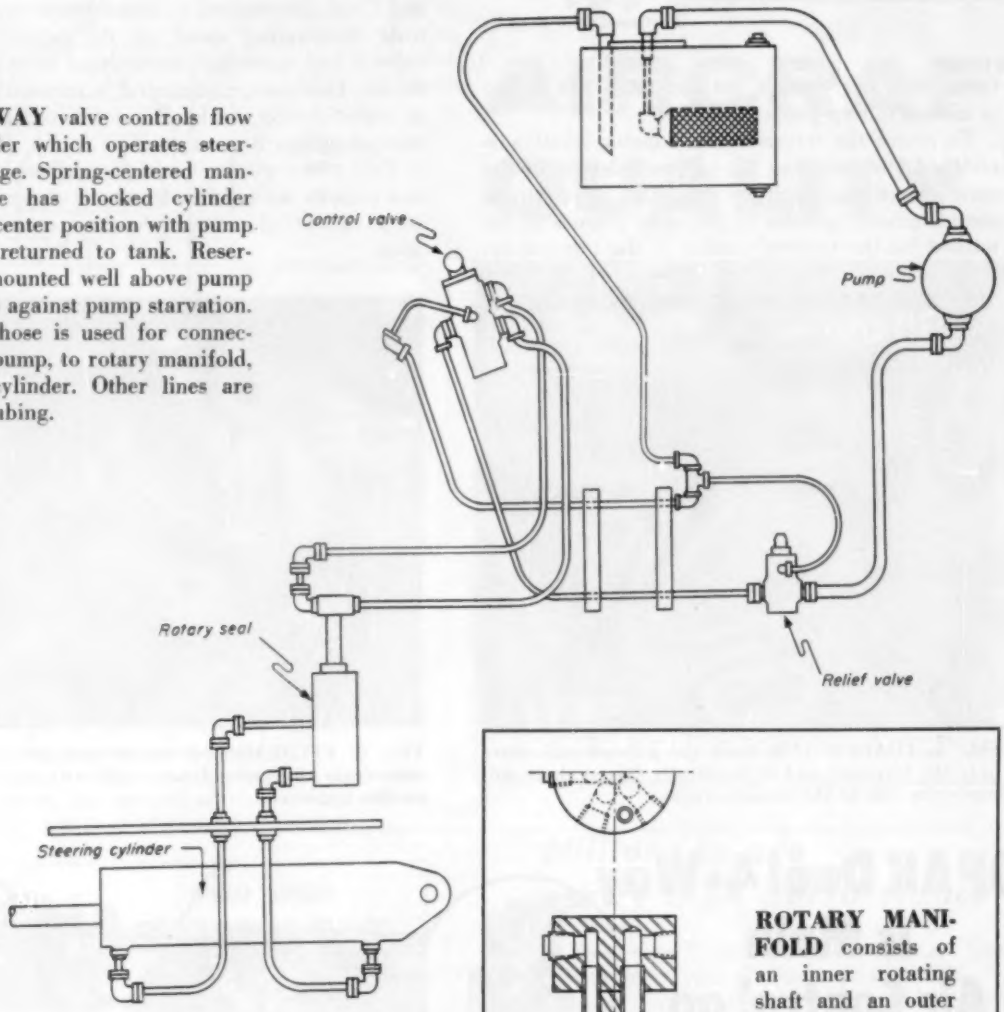


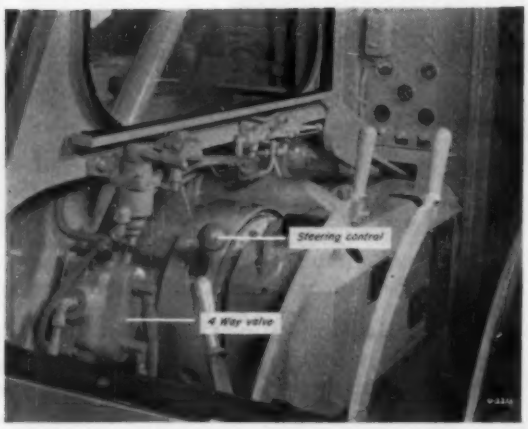
PUMP IS BRACKET MOUNTED on engine and is belt driven with air compressor from crankshaft. Pump is rated at 6.6 gpm delivery, 1500 psi. Hydraulic lines from overhead-mounted tank and to relief valve are flexible hose. Relief valve is bracket-mounted on frame.



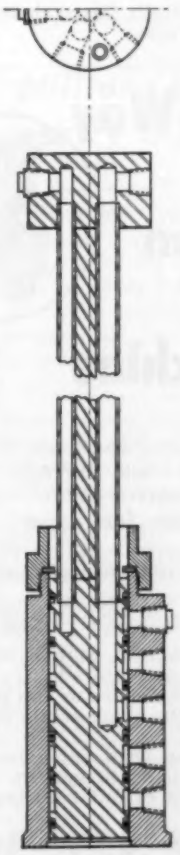
ONE CYLINDER mounted on left side of wheel frame actuates steering linkage. Flexible hose connects cylinder which is free to pivot in a horizontal or vertical plane about universal mounting.

FOUR-WAY valve controls flow to cylinder which operates steering linkage. Spring-centered manual valve has blocked cylinder ports in center position with pump delivery returned to tank. Reservoir is mounted well above pump to ensure against pump starvation. Flexible hose is used for connections to pump, to rotary manifold, and to cylinder. Other lines are copper tubing.





SINGLE HANDLE controls 4-way, 3-position valve to extend or retract cylinder. In center position spring-centered valve locks cylinder in position and unloads pump.



ROTARY MANIFOLD consists of an inner rotating shaft and an outer stationary shaft. Inner shaft rotates on O-rings spaced between collector ring grooves turned on inner shaft. Each of five holes drilled along axis of rotating shaft connects to a separate collector ring in lower section of shaft. Drawing shows section through No. 1 and No. 3 passages to corresponding collector rings.

PUMP STROKE CONTROL

Continued from page 54

the control arm through the remaining one degree of motion to stop pump delivery.

To return the traverser, fluid motor rotation is reversed by energizing the reverse solenoid of the main directional control valve. The pump stroke control circuit operates in the same manner as described for the forward motion of the traverse except when it goes into deceleration, both valves B and C are deenergized so that throttle valve 1 controls decelerating speed on the return. Throttle valve 2 had controlled deceleration on the forward stroke. This change of control is necessary because in one direction the load is a full tub and in the other direction it is empty.

This pump stroke system is extremely flexible and permits automatic adjustment of pump output in a variety of patterns for any cycle of operation. ▼▼▼

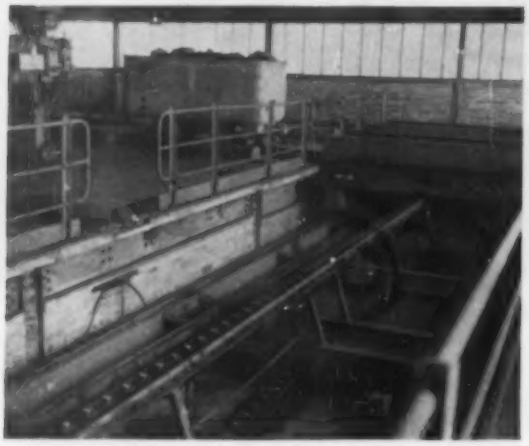
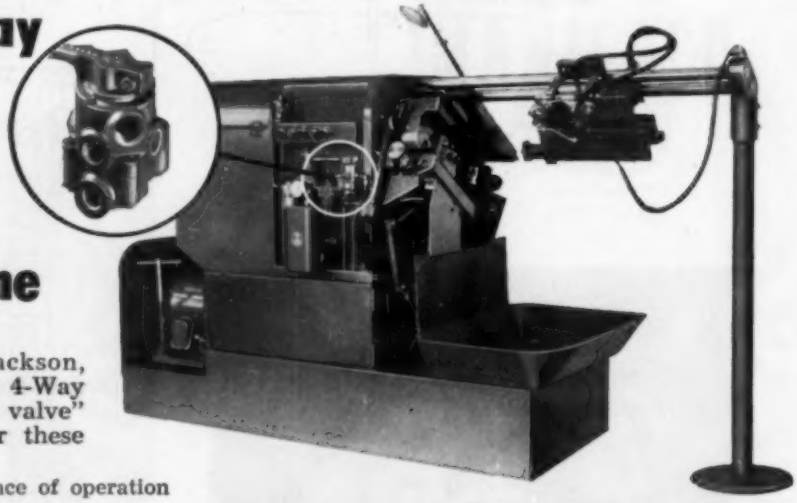


FIG. 5. LOADED TUB from the pithead will move onto the traverser and hydraulically driven chain will move the tub to the tippler tracks.

FIG. 6. PITHEAD and tippler are shown. Loaded tubs from the pithead move the traverser and over to the tippler.

NOPAK Dual 4-Way is Main Air Control on "Modern" Cutting-Off Machine



Modern Machine Tool Co., Jackson, Mich., uses the NOPAK Dual 4-Way valve as the "main air control valve" on its Cutting-Off Machine for these reasons:—

1. It provides the necessary sequence of operation control.
2. It is "easily mounted . . . in readily accessible position".
3. It directs air pressure either to part of the air system, or the whole system, as required.
4. With valve lever at 45°, "the operator can set the tools, with a gauge, against the stock while it (the stock) is locked in the collet".
5. In normal running position with valve lever at 90°, air is directed to other parts of system, while maintaining pressure on collet cylinder during cutting cycle.

This application may suggest how you can use NOPAK Valves and Cylinders for effective control and application of fluid power in your product, or in your plant equipment. For other suggestions see the NOPAK Application Manual.

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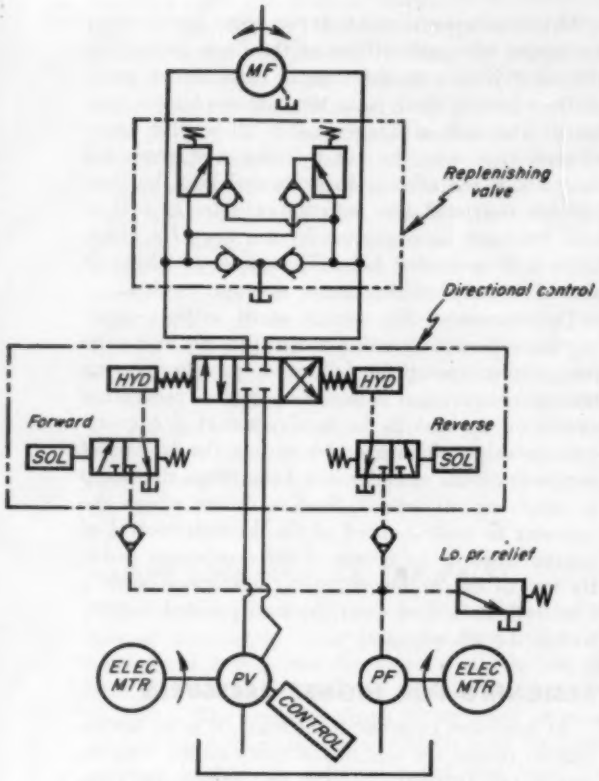
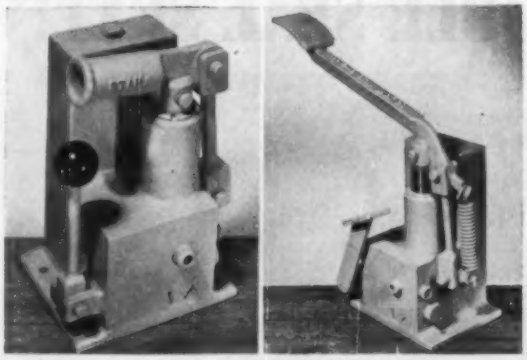


FIG. 7. TRAVERSER drive is powered by this transmission circuit. The control on the variable volume pump is the key to proper speed regulation.

STAR Hi-Lo TWO SPEED CONCENTRIC PUMPS



HAND OR FOOT OPERATED WITH SINGLE LEVER OR PEDAL

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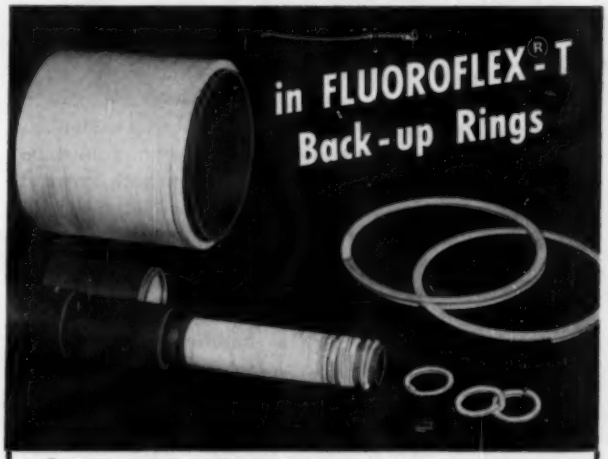

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Continued from page 62

itors the pressure drop across a fixed orifice, so that the metering plunger keeps the pressure drop across the orifice constant at all times. The type of valve which is probably best suited for controlled lowering is that which will allow the lowering speed to increase as the load is decreased. With this type of valve the orifice is decreased as the equilibrium pressure is increased, so that less flow occurs.

For the tilting operation it is necessary to have complete operator control to ensure safety. Double-acting cylinders are used, since the hoist must be brought to gravitational center from both forward tilt and backward tilt. The mast may force the tilt cylinders to move faster than the pump is supplying oil, creating a void or pulling air into the cylinder. Either of these conditions will cause a mushiness or loss of control when the mast is again brought back over center. Such a condition will allow the mast to tilt without actuation of the control valve and can cause dropping of the load, particularly while tilting with the load high in the air.

The design problems for tilt control are very similar to those for lifting, since smooth actuation and load holding characteristics are again needed. The problem of preventing cavitation in the tilt cylinders is being solved today in some installations by means of small orifices in the lines connecting the tilt cylinders to the control valve or by small orifices built directly into the hollow-plunger type valve. The hollow-plunger valve allows for unrestricted flow into the tilt cylinder and restricted flow out. Fixed orifices incorporated into the lines provide restricted flow into the cylinder as well as out. This can be overcome by the use of a check valve with a drilled hole. The speed of tilting is slowed down providing better operator control.

Unfortunately, the use of small orifices slowing down the tilting action means that the hydraulic pump must operate at full relief pressure during the tilting operation. A better method of preventing cavitation appears to be in the use of a counterbalance valve which operates so that the oil cannot escape from the cylinder any faster than the pump is supplying oil into it. Such a device allows the operator to control speed of tilt through control of engine speed or by means of the accelerator pedal. By use of the hollow-plunger construction such a counterbalance device can be incorporated directly within the tilt plunger.

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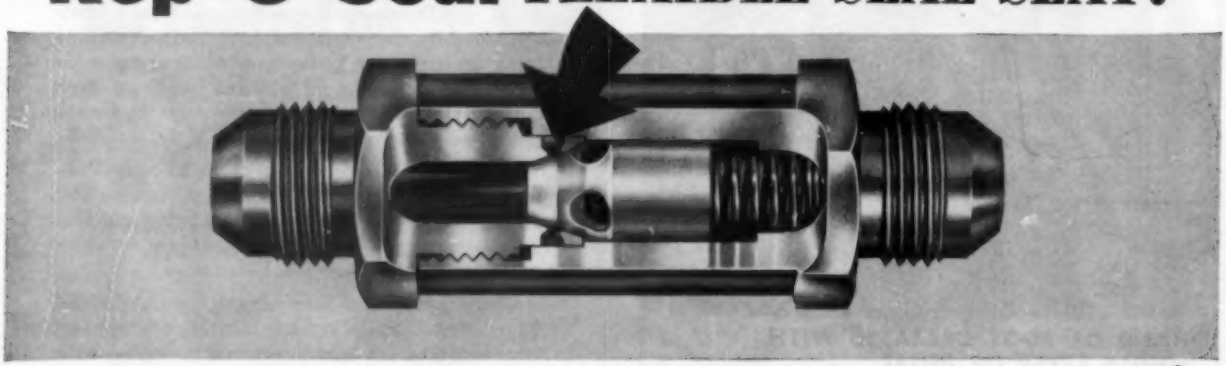

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lowering must still be maintained, the oil velocities tend to increase. As a result the pressure drops through the system become increasingly important. As we attempt to force oil back to the tank at a faster rate, the possibility of back pressure at the main control valve housing is increased. This excessive back pressure has a tendency to cause the control valve plungers to pop out since in many designs they are unbalanced axially. To solve this problem, axially balanced plungers must be used. When we increase to higher pressures it also becomes necessary to machine the lands, since any misalignment of the coring will cause annular unbalance and sticking. In addition, the problem of maintaining good timing and good throttling can be solved at higher pressures only by accurate relationships of the plunger shoulder to the core lands. With the use of machined lands, very accurate, short sealing land lengths can be obtained with the possibility of a shorter valve.

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Problems of pressure drop in the control valve become increasingly important because hydraulic horsepower loss across the valve is a function of both the flow in gpm and the pressure drop across the valve. The pressure drops which must be considered are through the center bypass from the high pressure inlet to the cylinder outlet, and from the cylinder return to the low pressure outlet to the tank. With the trend toward higher pressures, the JIC straight thread and O-ring type fittings and the SAE flange connection must be considered. ▼▼▼

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HIGH TEMPERATURE FLUID, PACKING and OPERATING PROBLEMS

OVER 200 persons representing the Services, the leading airframe manufacturers and suppliers attended the fall meeting of SAE A-6 Committee, Aircraft Hydraulic and Pneumatic Equipment. The full agenda reflected the high temperature problems with discussions on high temperature fluids, packings, high temperature hydraulic systems, filters and "O" rings. As has been the practice in the past several years, the pneumatic items were discussed first under the chairmanship of A. H. Hobelman, chairman of the Pneumatic Subcommittee; followed by system materials items when F. O. Hosterman, chairman of the Materials Subcommittee, presided, after which other items on the agenda were considered by the Committee with B. R. Teree presiding.

It was apparent that the number and importance of pneumatic items on the agenda has increased. The major pneumatic discussions were on MIL-R-8573 (Aer) Specification, Reservoirs, Air, Non Shatterable; MIL-P-5518, Pneumatic Systems, Design, Installation and Tests in Aircraft; and new MS 28889 Air Valve.

MIL-R-8573, reservoirs, air, non shatterable: The Kidde representative presented the problem. Due to the fact that there are two air bottle specs (steel and fiberglass) and most bottles are furnished with drain fitting assemblies on one part number, a good deal of confusion has resulted. He asked approval of the Committee to propose a method of attachment of the drain fitting assembly to the bottle. The WADC representative reported on a proposed spec for fiberglass air reservoirs. The Committee agreed to ask WADC to issue this item an an AF spec. The chairman asked the Kidde representative and the Republic member to fill in the loopholes and to report at the next meeting.

MIL-P-5518 pneumatic systems: The Kidde representative reviewed the tests conducted by his company on the standardization of high temperature testing of pneumatic components. Following the procedure recommended by the hydraulic panel at the last meeting, tests were conducted at —65 F and 275 F. Three combinations of soak and high temperature cycling were run: (1) 75 hours soak and 20,000 cycles; (2) 6 hours soak and 15 percent of cycles at 275 F; and (3) 6 hours soak and 15 percent of cycles at 225F. On the basis of the tests, he recommended that 10 percent of cycles be run at 275 F.

On the question of overhaul periods, BuAer pointed out that practices vary widely from base to base. The TWA member reported that they have consistently enjoyed long service life. The committee took no definite action on this item.

Discussion developed the fact that ground charging has been found inadequate for filtering and dehydration in some cases. A BuAer Materials Lab representative gave details of troubles encountered both with moisture and oil. The WADC representa-

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tive stated that 140 ground charging units (MC-1 units with 10 micron filters and dehydration equipment) are in field operation and that a rework kit (Type 11C-1) also provides adequate filtration and dehydration. The committee decided that —65 F dew point was a necessity and that the difficulties were probably due to lack of maintenance.

MS 23889, Air valve: The WADC member stated that this new air valve has proven inadequate for charging pneumatic systems. Considerable discussion ensued on both a method and the equipment required to determine the location of leakage and the leakage rate. The WADC Materials Lab is working on this problem. Comments from representatives of two of the airframe companies most concerned with pneumatic systems—Convair and North American—established the fact that serious leakage problems exist. The North American representative reported that flareless fittings had given the best results. The chairman asked that an industry survey be made and reported back at the next meeting.

The chairman distributed copies of an industry survey on pneumatic filters. Two types, —65 to 275 F and —65 to 600 F, were covered. The crux of the discussion was on the degree of filtration. The chairman turned the problem over to BuAer.

Materials: Major items discussed included packings and backup rings in high temperature hydraulic systems (275 F), equipment testing at 275 F and MIL-P-5514, General Specification for Installation and Gland Design of Aircraft Hydraulic and Pneumatic Packings.

A WADC representative stated that only one compound has been approved under MIL-P-18017 (275 F hydraulic systems). He went on to say that an unexpected corrosion problem has developed. He pointed out that the magnitude of the testing problem was staggering. Of a total of 1257 compounds developed for packings, 140 have been received at WADC. The lack of conformity among suppliers testing and the fact that the Services are not using ASTM procedures have added to the difficulty. No packing has passed the entire set of specification tests for —65 to 275 F operation.

The North American member pointed out that typical flight testing was yet to be done. WADC is to continue their tests. On the basis of the discussion, the chairman will write a letter to SAE requesting that airframe company testing be in the —50 to 275 F range. The Parker representative mentioned that 80 to 85 percent of packings were for static sealing and suggested that static and dynamic seal breakdown tests be differentiated as far as practical. The Republic member cautioned that the packings were the best that intensive research has come up with and that they go ahead and test and use the "O" rings since they had to live with the problem. The chairman summarized: the packings are the best available; a committee letter will go to the Services asking leniency to packing manufacturers during the interim period; and he asked that airframe experience be reported to the committee.

The Douglas, El Segundo, member distributed copies of an industry survey on the standardization of single turn scarf-cut backup rings. There was substantial comittee agreement on these rings (MS 28782 and 28783, teflon).

The North American member again reviewed the progress made by the high temperature panel, pointing out that changes in ground rules had added to their difficulties. The spec on general components (MIL-H-19066, Aer) was followed as closely as possible. The BuAer representative pointed out that two additional specs on hydraulic control and check valves (V-19067 and V-19068) Aer, are available from the Technical Records Division, U. S. Naval Station, Johnsville, Pa.

The realism of a fixed limit of 275 F was discussed. The committee agreed with the panel definition that 275 F should be considered as the maximum stabilized temperature of the component.

MIL-P-5514, Packing design and installation: The National Water Lift representative went over proposed modifications in this spec. The committee approved the removal of pneumatic packings from this spec, the shift of scraper rings to MIL-C-5503, Hydraulic Actuating Cylinders, the recommendation of a change in groove surface finish from 30 to 64 and the side angle of the groove to 0-2 degrees (from 0-5 to 0-6 degrees). The chairman asked the National Water Lift representative to make these changes in the proposed revised spec and to circulate the revision to the committee, airframe companies and others who asked specifically for them.

High temperature hydraulic systems—400 F: The North American, Downey, representative reviewed their experience and efforts to meet this spec (MIL-H-8446, High Temperature Fluid, —65 to 400 F). One series of test were made with a modified OS-45 fluid using neoprene W "O" rings. Better results were obtained with poly FBA rings. In both cases spiral teflon backup rings and solid metal rings were used on separate runs.

The Republic member reported good results with teflon rings at 400 F but that they had experienced feathering out at 500 F. He reported that the best results at 500 F had been achieved with ceramic loaded teflon. Experiments with rectangular and triangular sections, 45 and 30 degree bases in the latter, indicated that the 30 degree base angle was much better than the 45 degree base angle and very definitely better than the rectangular. Republic tests also included piston rings. Although piston rings required large clearances very good results were obtained at pressures up to 3000 psi; there was practically no leakage at temperatures from room to 400 F.

In answer to an inquiry why MIL-L-7808 fluid had not been used for systems in the 400 F class, the North American, Downey, member cited their early tests with this fluid. He stated that this fluid quickly and badly disintegrated at 400 F. The Hamilton Standard representative reviewed their

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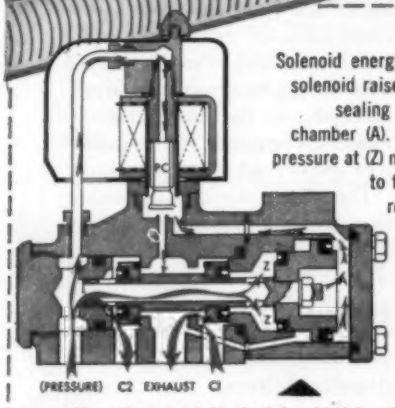
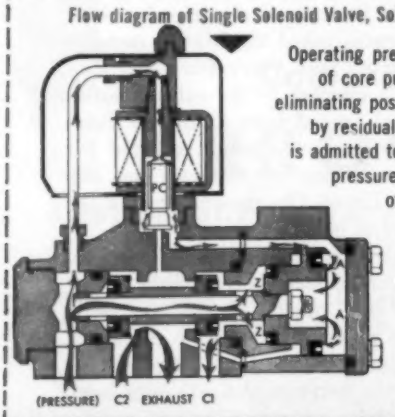


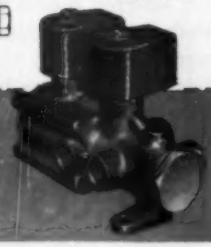
Solenoid energized — energizing the solenoid raises the pilot core (PC) sealing the pressure inlet to chamber (A). (A) is exhausted and pressure at (Z) moves the valve piston to the right. Pressure on resilient inserts forces them against the metallic junction of disc and seat in an absolutely tight seal.

Flow diagram of Single Solenoid Valve, Solenoid Energized

Flow diagram of Single Solenoid Valve, Solenoid De-energized



Operating pressure applied to top of core pushes it off the seat, eliminating possible sticking caused by residual magnetism. Pressure is admitted to (A). While the same pressure exists on both sides of the piston, (A and Z) the area on the right is greater. The resultant force moves the piston to the left.



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experience with 7808, stating that fluid characteristics varied considerably from one supplier to another and from one lot of the same supplier to another lot and that sludges and varnishes were formed. A WADC representative reported that 7808 has been used successfully in systems to 300 F.

A General Electric representative presented a suggestion to breakdown the range of temperature for high temperature hydraulic systems into five sections in an effort to standardize this very wide spec. The suggestion was in brief:

(1) —65 to 275 F MIL-O-5606
(2) —65 to 400 F MLO-8200 (OS-45, etc.)
(3) —40 to 400 F MIL-O-7808
(4) —65 to 600 F Silocones ?
(5) 0 to 800 F Fluid X ?

MIL-P-5516 Hydraulic packings and gaskets: The ASG representative reported that an ANA Bulletin on "Age Control of Hydraulic Packings" was now ready and was out for AF approval. Sections of special interest to the committee are on rubber parts for hydraulic and pneumatic systems (MIL-P-1150 and 5516) and hose and hose accessories (MIL-H-5511 and 5512).

The chairman of the "O" Ring Panel reported that the drawings on the D-ring had been completed. The drawings were accepted by the Committee.

MIL-H-5440 Hydraulics systems: The Republic member outlined the progress made on the proposed revision of this spec. The Martin member, reporting on a survey, stated that the net result was no recommended changes. A representative of WADC reported that, due to the increased complexity of checking multiple hydraulic systems simultaneously, they were not far enough along to report. The chairman asked for a report at the next meeting.

MIL-F-5504, Hydraulic filters: The Martin member distributed copies of an industry survey summary on 2-5 micron filters. Comments were read and discussed. Because of the importance of this item, the chairman asked the Martin member to continue this survey with every filter manufacturer interested as a member of the subcommittee.

Filter life reported ranged from 25 to 150 hours —the range of 50-150 hours being reported for fighter aircraft. The longest life reported was 300 hours for reservoir filters. The chairman asked the Services to continue to collect data.

There was no agreement on the permissible contaminant size for good system performance.

At the request of the Douglas, El Segundo, member sintered bronze types of filters were discussed. Both the sintered sphere and the brazed screen types were discussed by the Services. An AF representative stated that they have a contract for such testing. The chairman asked for a report at the next meeting.

The Purolator member stated that the top limit of operation of the AN paper micronic filter element was 275 F.

MIL-H-8775, Hydraulic components: The chairman stated that the 275 F section of this spec was being prepared by BuAer and will be issued by them without a QPL.

The Republic member, who conducted the original survey, reported a letter from CMAS regarding a suggestion for non-symmetrical design of components (valves, fittings, etc.).

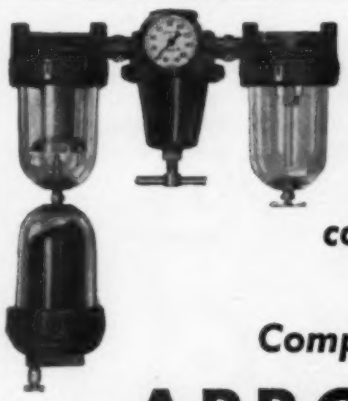
The North American, Downey, member, read a prepared paper, "Evaluation Methods for Aircraft Hydraulic Filters". The paper treated filter capacity, gave examples of techniques of evaluating fineness of filtration and briefly described three methods of efficiency evaluation.

Several changes recommended by the Adel member in MIL-P-5517, Specification, Plastics Parts in Aircraft Hydraulic Equipment, were approved by the committee and forwarded to BuAer.

A number of other items including pressure gages for high temperature work, tubing and fittings, bosses, self sealing couplings, environmental testing of hydraulic and pneumatic components, shuttle and fire all shut off valves were also discussed.

Five new members have been added to A-6 Committee since the last meeting: R. F. Stapells of Canadair, G. R. Keller of North American (Downey), K. W. DuBois of Douglas El Segundo, G. C. Newell of Boeing, Seattle, W. F. Talbot of Northrop and Carl Chambers of Douglas, Santa Monica.

In closing the meeting the chairman stated that the next meeting of A-6 would be at the Conrad Hilton Hotel, Chicago, May 2-4, 1956. ▼▼▼



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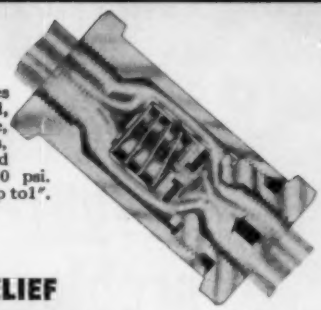

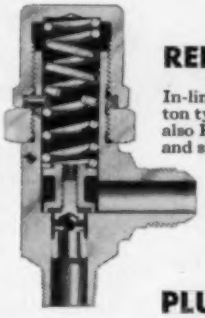

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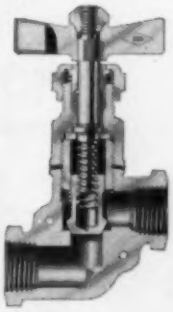

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AVIATION HOSE and FITTINGS

ROBERT W. Phillips, temporary chairman, presided over the SAE Committee A-3 fall meeting which was attended by more than sixty representatives of airframe manufacturers, suppliers and representatives of the Services.

Among the items given particular attention were the new hollow forged fittings, surface defects on nose sealing surfaces, two new proposed specifications for aircraft fuel and oil system high pressure hose and changes in MIL-H-5512 hose assemblies.

Hollow forged fittings: The Weatherhead representative distributed samples of the new hollow forged fittings. He reported that this forging technique saved an average of 42 percent of metal as compared to the conventional manufacturing technique and that the hollow forged fittings had been tested to 225,000 cycles as compared to the 80,000 cycles for regular solid forged fittings in breakdown tests. Sizes up to —16 have been hollow cast.

A considerable discussion developed with the distribution of a report on surface defects on nose sealing surfaces. The report disclosed that the surface finish of 100 rms of the critical area has been satisfactory. The Convair representative objected that the report was superfluous since AN fittings were giving way to MS specs.

Fitting Materials: The Republic committee member suggested that stainless steel and titanium be added as recommended materials. The WADC representative stated their position of avoiding whenever possible the use of stainless and other critical materials. He also expressed their position that cadmium plating be avoided whenever possible. A new nickel plating technique was reported as promising. The chairman asked that a fuller report be given at the next meeting.

Hose Specs: Copies of the two proposed specs: for Hose for General use in Aircraft Plumbing in Fuel and Oil Systems and for Lightweight Hose for General Use in Airframe Plumbing in the Fuel and Oil Systems were distributed by the Lightweight Hose Subcommittees. The lightweight hose spec was approved. Discussion on the high pressure hose centered around the permissible ID. The concensus of opinion was that a larger ID would be necessary.

On the MIL-H-5512 Hose Assembly specification, not enough answers had been received from the airframe industry for committee action. In the meantime, MIL specs 8788, 8789 and 8790, covering the same ground as MIL-H-5512 but with corrections incorporated, would be in use. The WADC representative reported that the revised MIL-H-5512B would be issued in 30-60 days.

Two items were devoted to teflon hose. Two sizes of low pressure teflon hose had been proposed by hose manufacturers. One series:

—4 3/16
—6 5/16
—8 13/32
—10 1/2
—12 5/8

was approved for coordination.

A WADC representative presented the results of tests with high pressure teflon hose. The tests were conducted with OS-45 fluid at 400 F and an ambient air temperature of 425 F. Specimen hoses were run 125,000 cycles. Hoses which successfully completed this test were then cold flexed. At present teflon hose is approved only for synthetic oils.

Additional points on hose were discussed. The proposed tests for rubber bonded spiral hose were not conducted because a satisfac-

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PH341	3"	4"	1"1/8"	1500	Inserted	"	32.50
PH381	3"	8"	1-1/8"	1500	"	"	35.00
PH45E	4"	5"	1-1/8"	1500	External Threaded	18,750 lbs.	37.50
PH46E	4"	6"	1-1/8"	1500	" "	"	39.50
PH48E	4"	8"	1-1/8"	1500	" "	"	43.50
PH410E	4"	10"	1-1/8"	1500	" "	"	47.50
PH412E	4"	12"	1-1/8"	1500	" "	"	51.50
PH45E3	4"	5"	1-1/2"	3000	" "	37,500 lbs.	52.50
PH46E3	4"	6"	1-1/2"	3000	" "	"	54.50
PH48E3	4"	8"	1-1/2"	3000	" "	"	58.50
PH410E3	4"	10"	1-1/2"	3000	" "	"	62.50
PH412E3	4"	12"	1-1/2"	3000	" "	"	66.50
PH518I	5"	18"	2"	3000	Inserted	59,250 lbs.	85.00
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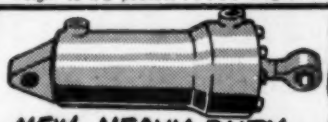

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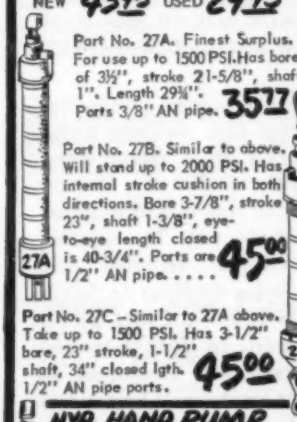

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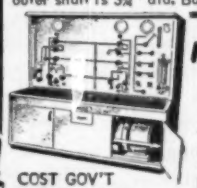

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MF9-713-15A	.310	4.46	1000	3750	—	$18.50
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MF9-713-25BCF	.507	8.25	1000	3750	—	$22.50

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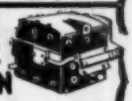

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AVIATION HOSE AND FITTINGS

AVIATION

tory synthetic bond had been developed. Tests conducted by the Materials Laboratory, WADC, on sizes —10, —16 and —20 of poly FBA hose were reported. Low temperature to —10 F were run. The condition of the hose after high temperature tests was considered not good. Further testing is in progress.

The ASG representative reported that they are now reviewing industry comments on MIL-H-5511 Hose Specification and Hose Assembly Specification. The revised specification is to be published shortly.

The Weatherhead representative reported that the flareless fitting torques for hose assemblies are about ready and will be distributed for comment very shortly.

The United States Rubber representatives reported good initial results on their survey of impulse test equipment and that data would probably be ready for reporting at the next meeting.

The next meeting of A-3 Committee will be held on April 30, 1956 at the Conrad Hilton Hotel, Chicago. ▼▼▼

PUMPS and MOTORS for JET AIRCRAFT

DISCUSSIONS on high temperature, high capacity hydraulic pumps and pump reliability were featured at the SAE A-6C Sub-Committee, Hydraulic Pumps, Motors and Air Compressors, meeting in October. Over 100 representatives of major airframe companies, hydraulic component manufacturers and the Services were present when Chairman J. A. Mileti called the meeting to order.

Packing problems: The New York Air Brake member pointed out the two limiting factors of high temperature pump operation: (1) the critical problem of packings and; (2) the unavailability of suitable hydraulic fluids. He stated that pump packings, not shaft seals, was the most critical limiting factor; the best fluids tested had a breakdown life of only 100 hours at 400 F. The Hamilton Standard member reported fluids as their big problem. He went on to say that they had eliminated packings with any type of elastomeres and that several new aluminum alloys had been tested as pump parts. A difficulty disclosed was the low tensile strength at 400 F. He also reported that the small clearances of pump parts became critical at 400 F.

The Vickers member reported trouble with elastomeres, stating that approximately 70 percent of troubles developed were with seals.

The Bendix Eclipse representative reported that packings broke down quickly in a pump using MIL-F-7808 at 350 F. He reported the oil was in bad shape at the end of the test. The General Electric member reported that bearings had a tendency to "walk around" at 350 F and that the oil life was short. In their tests elastomeres have been eliminated as seals; their most recent testing has been with stainless steel gaskets and metallic "O" rings. Both fluids used, MLO 8200 and WADC 8515, have stood up well. The Bendix Hamilton member reported good results with a small capacity pump (.2 cu/rev and operation at 5000 rpm) with controlled calrod heating. The pump ran 15 hours above 400 F, and one-half hour at 570 F with metallic "O" rings.

Pump break-in tests: BuAer reported that conformance to spec

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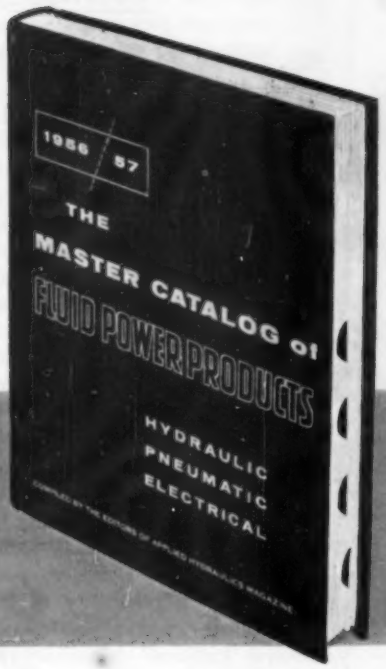

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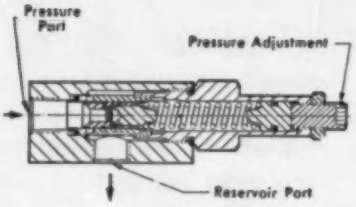

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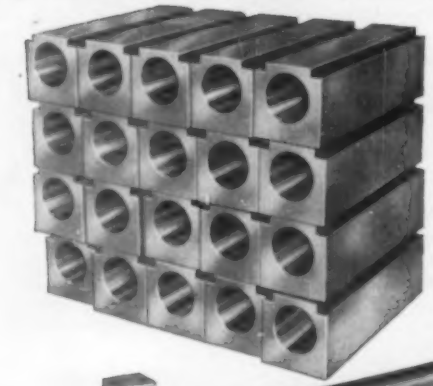

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PUMPS AND MOTORS

AVIATION

MIL-P-7740, Pumps, Hydraulic, Power Driven, Variable Delivery, has not proven adequate to insure satisfactory pump operation in naval aircraft. They distributed a chart indicating that half of 665 pump failures (1950-1953 and January-June 1955) occured within 125 hours and suggested that pump suppliers make a 25 hour break-in test before delivery.

The New York Air Brake member stated that, while they were willing to run a break-in test, he questioned whether this was an effectual approach. A Vickers aircraft representative quoted an unusually high reliability test on 3500 pumps in a leading airline operation, where 1,900,000 pump hours gave a reliability of 99.8 percent over a five year period. Several builders of military aircraft pointed out that pump operation in military aircraft is much more severe than in airline operation and that airline figures would not apply. The Lockheed representative suggested that the big stumbling block was the large factor of ignorance—the difficulty of learning exact operating information.

The chairman asked that the New York Air Brake and Vickers members confer with BuAer in an effort to secure more exact information on pump failures and then report back to Committee A-6C.

MIL-P-7740B Variable Delivery pumps: Two proposed revisions to MIL-P-7740 were reviewed. The New York Air Brake member reviewed the problem of transient pressure vs flow rate. After some discussion it was agreed that .05 sec recovery and one second for a complete cycle was satisfactory.

AND-20000 series standard drives: The Pratt & Whitney representative reported that the tabulation of the 8000 rpm accessory power drives, worked out at the AE-1 Accessory Drive Panel in May would be ready in January, 1956. He also reported on the AND-10050 bosses which have been made with unified threads. He reported that his and one other major engine maker were still en-

Circle 6 on Reader Service Card

countering leakage trouble. The Lockheed representative expressed dissatisfaction with the bosses. The chairman turned the problem over to the A-6 Committee.

MIL-M-7997 constant displacement motors: The Vickers member distributed copies and discussed proposed changes worked out with the Lockheed representative. Two important changes were proposed: (1) the stalled torque requirement, (2) the addition of reversals under load to the endurance test. The stalled output torque was proposed to be measured with rated inlet pressure, 0 psi gage outlet pressure and 0 psi gage case drain line pressure at 36 equally spaced positions on the output shaft within one revolution. The minimum torque required to move the torque arm from a stalled horizontal position was specified in relation to a torque table. On the endurance test the committee decided, after discussion, to revise the time requirement to include 50 hours of reversals (at a high rate to get a large number of reversals). The Vickers member was directed to make these changes.

No satisfactory solution has been found for MIL-L-6086A, Air Compressor Lubricating Oil.

Pump operation with air-oil mixtures: A General Electric (Gas Turbine) representative reviewed difficulties in determining the difference between entrained air and dissolved air in hydraulic fluids. The Lockheed representative reminded the committee that at least five percent of entrained air has always been present and that everyone has been living with this problem. The Convair representative stated that entrained air was critical on servosystems. The chairman decided to set up a short paper on entrained and dissolved air for the next meeting. The assignment will be made later.

Three new members have been added to the A-6C Subcommittee since their last meeting: L. D. Savage, Cornelius Co.; L. T. Stoyke, Lear Romec Div. Lear, Inc.; and T. E. Doherty, Hamilton Standard.

The next A-6C meeting will be held at the Conrad Hilton Hotel, Chicago, May 1, 1956. ▼▼▼

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...AN AH STAFF REPORT....

1955 NCIH

With three technical sessions going on concurrently at the 11th annual meeting of the National Conference on Industrial Hydraulics in Chicago, October 27 and 28th, APPLIED HYDRAULICS sent three editors to bring back ideas from all the meetings. In the October issue of AH, the complete program and abstracts of 19 of the 20 technical papers presented at the conference, were published. If you want complete copies of any of the papers write to the NCIH Conference Secretary, Illinois Institute of Technology, Chicago, Illinois. He may have individual copies of the paper you want, and he'll also tell you how to order a copy of the conference proceedings to be published early in 1956.

• **What the NCIH does:** There's more to the NCIH than the very important annual two day conference. Illinois Tech's Dean R. G. Owens told about the educational program sponsored by the NCIH. So far, non-credit courses at the maintenance and sales level have been sponsored. Starting in February, a 16-session evening course, "Introduction to Oil Hydraulic Power", will be offered.

Dean Owens asked, "Should courses at a high level be offered to graduate students and to men from industry?" Would engineers in industry attend an intensive "short" summer course tailored for the component and systems designer?

There is also one graduate fellowship presently sponsored by NCIH at Illinois Tech. The subject of the fellowship thesis is "Electrical Analogies to Oil Hydraulic Circuits". When it is completed, this thesis will be available to conference members. Enough money is available so that next year two fellowships in oil hydraulics will be offered.

• **Use a computer?** The job which electronic analog computers can do for designers of fluid power systems was discussed in the first session of the conference. Remembering the pain with which we parted with $15.00 for our first good, second hand, log log slide rule, for courses at good old Case Tech, we could appreciate that automatic computers have come a long way. Along with the cost problem, there's one other very important comparison between our slide rule and the computer—to get a good answer, the right figures from a proper equation must be fed into the computer. Carrying the analogy between our slide rule and computer one step further; the value of each lies in its speed, accuracy and simplicity of changing parameters as compared to longhand mathematics.

• **One important byproduct** of the analog computer is that the engineer can "feel" the problem. Mechanical, temperature, hydraulic and other variables are produced as voltages and these can be changed by setting potentiometers. The engineer can easily change the conditions of the problem and study it at various stages.

• **Computer limitations:** Each unit has built-in errors which must be understood. Certainly the use of a computer forces careful formulation of a problem. Gerhard Reethof, who has recently left the MIT faculty to join Vickers, Inc., analyzed a typical metercut circuit showing how to setup the equation which the computer is asked to solve.

Partial differential equations are still a knotty problem for analog computers. J. D. Strong, Princeton Computation Center, explained that methods are in use for their solution, but the equipment is still expensive. Mr. Strong and H. M. Martinez, U. S. Naval Post Graduate School, described actual construction and operation of computers.

• **Hydraulics on automobiles:** There's no question about the use of hydraulic pressure to power passenger car brakes, steering and automatic transmission controls. These three operations appear to be the only ones about which there isn't too much controversy. Discussion of the two papers presented at the automotive session indicates that proponents of hydraulic power for fan, generator, and air conditioning drives, window, windshield wiper, seat positioner, and convertible top operation are going to have to work hard and fast to develop acceptable circuits.

• **Cost and service** require-

Continued

ments appear to be the big obstacles. John Lauck, Pesco Div., whose paper was titled "Central Automotive Hydraulic Systems" indicated that many problems remained to be solved to get a practical central hydraulic installation. The possibilities of applying oil power for all devices is remote. Application for some devices may be chosen and certainly offers advantages. For example, a hydraulic generator drive would permit location at any point away from the engine. A fan drive with a hydraulically operated, temperature responsive clutch is in development on some models.

• **Pump for automotive hydraulics** is a critical factor. A fixed displacement unit gives poor efficiency over the required speed range. The answer is between a circuit using a fixed delivery pump and accumulator, or a circuit using a variable delivery pump. It was reported that a servo controlled, pressure operated, variable displacement pump has been developed for these circuits. Its design is still under wraps.

• **Suspension systems:** With cars getting lower and closer to the ground, the designer of suspension systems is being hard pressed for space. D. W. Lipp, Monroe Auto Equipment, described a compact air-hydraulic system. One of the difficulties here is the need for an engine mounted air compressor. It adds one more device to the increasing maze of components under the hood. This suspension system does offer superior riding comfort. Why haven't air springs been used for years on passenger cars as they have been on trucks and buses? Probably because there's no payload problem on a passenger car, and also cost and space limitations have, up to now, made this system objectionable. However, there is interest from all suspension designers because the air hydraulic system holds the possibility of a better product, it may have sales value, and cars are getting lower every year. The key to its success may lie in its ability to provide automatic height control. As an afterthought we can't help but wonder how the torsion bar suspension compares.

• **Pump control:** There's great interest in circuits and instrumentation to automatically control pump delivery for speed regualtion of the work load. Milton G. Malmquist, Minnesota Mining and Manufacturing Company, told about their development work on drives for processing their tape products. Their circuits use a variable displacement pump supplying a fixed displacement motor. The aim is to eliminate slackening and tightening of the web due to speed changes of the processing rolls. In these circuits there is one master drive; the rest are slaves which respond to changes of the master to maintain synchronization or some fixed speed relationship. Drive stability and proper re-

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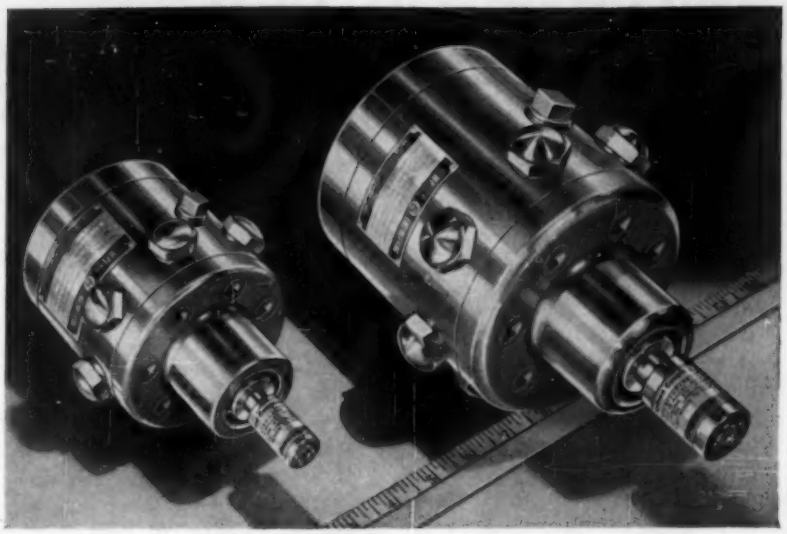
sponse are the tough things to accomplish. Requirements for each drive varies with the type of material being processed.

• **Putting on his "space helmet",** Malmquist described what components he would like to see developed. He would like an unloading valve and hydraulic slide block positioner in which the gain might be adjusted after installation. Although performance of hydrostatic transmission is good, potentialities of the drives are presently limited by control systems. There's need for cataloged items, with adjustable characteristics, which could be assembled and then controlled from a few knobs. Small, compact, low cost pumps for tachometers are unavailable.

• **Predicting drive performance,** R. E. Davis, Oilgear, told about laboratory performance measurements. Results of this work offer considerable promise for increased reliability and easier selection of precision drives for automatic processes. It would seem that increasing need for precision drives will permit manufacturers to make the investment in time and money which is necessary to do this type of performance measurement work.

• **Design for mobile equipment:** Papers at this NCIH session fit into the theme of this month's editorial features. Design of the Hydra-Touch system used on International Harvester's farm and industrial tractors emphasizes simplicity to reduce maintenance and increase reliability, and stresses design for ease of operation. Valves are pad-mounted directly on the reservoir. Flow passages between the pump pressure line and valves are in the reservoir.

• **"Hydraulics and Dirt"** could have been the title of Joe Slomer's paper which detailed circuits for mining machines built by Goodman Mfg. Company. On these machines, there's lots of hydraulics—at least 15 cylinders—all operated under the worst possible conditions of dust and dirt. This dirt



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Continued

problem, makes use of a closed system a necessity. Exposed piston protection takes on increased importance as does safety features to protect equipment and operator.

• **Presses and servos:** Control systems are of great importance in the heavy press program, and the latest techniques are being applied. Servo controls are being used to synchronize the strokes of cylinders on large presses. New considerations in designing heavy forging presses presented by L. Mollick, Loewy Construction Co. are speed, temperature, and confinement of the billet. One big problem is eccentric loading which can be corrected by use of compensating cylinders. Strain gages on the tie rods measure the bending stress, and the strain gage output is fed to an electronic circuit controlling the hydraulic system to correct the eccentricity.

• **Leakage** is the principle source of natural damping in a hydraulic servo system. However, R. G. Spencer, Vickers, Inc. pointed out this damping is achieved only with a waste of power. Damping is more favorably accomplished by pressure feed-back.

• **Better system plumbing** by close cooperation between equipment builders and tubing fabricators was the keynote of a paper by H. Dorman, Powertube Engineering Co. "Tubing must be taken out of the field of trinkets and trash," he stated in stressing the advantages of pre-fabricated tubing tailored for the application. The fabricators have a need for a flexible tube bending machine which is not special for one job.

• **Standardization of tubing wall thickness** is the aim of the fabricators. Standards should be based on the requirements for flexibility, reduction of noise, and bending. Standards are needed for between welded and seamless tub-hardness and tolerances especially ing.

• **Welded tubing** has good possibilities and engineers should specify it for use with brazed manifolds to get the advantage of lower cost.

• **One problem faced by fabricators** is cleaning and degreasing tubing from the mill and re-protecting it after bending. They want a permanent preparation applied by the mill.

• **The most important considerations** in selection of swivel joints are type and speed of movement. J. O. Heyworth, Barco Manufacturing Co. also added the requirements of pressure, temperature, and gasket materials. That swivel joints have been in use for 25 years was cited by G. M. Bagnard, Chiksan Co. They are available for any industrial or aircraft pressure now in use. They must not be treated as just another plumbing fitting, but are precise

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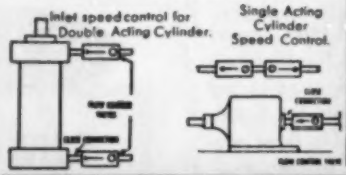

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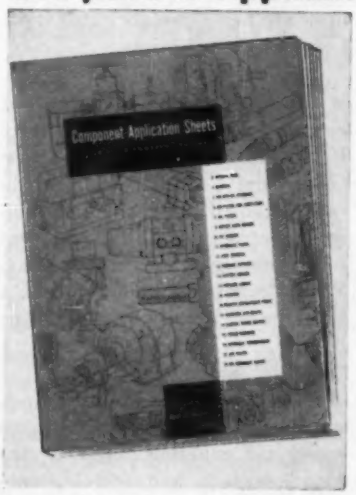

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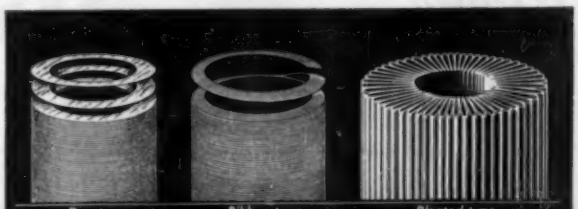

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mechanical units which must be selected carefully.

• **Flexibility in fluid lines** is usually obtained with hose which may be the cheapest way, but swivel joints offer greater safety at higher pressures and temperatures. The best design may be a combination of these, with Swivel joints preventing any twisting of the hose. Aircraft applications of swivel joints are increasing because of severe conditions and high reliability standards. It was reported there has never been an operating failure because of swivel joints on aircraft.

• **Tubing must be final tested** after it is installed on the equipment. R. Dean, Clayton Mark & Co. indicated that leaks due to imperfections in the billet from the mill may not show up until this time.

• **Aircraft tube prefabrication** is being done now, but there are problems. Control of narrow tolerances is difficult and tooling is expensive. However many assemblies are being prefabricated from hose and swivel joints.

• **Machine tools:** Advantages of electrical controls ennumerated by R. C. Montanus, Springfield Machine Tool Co. include ability to inch in small increments, centralized control, flexibility, and ease of sequencing and interlocking. With electro-hydraulic controls, a machine is virtually set up for tape control.

• **New problems facing grinder manufacturers** are requirements for grinding holes on contour internally and grinding contoured radial surfaces. These challenges were presented by W. M. Engelbrecht, Chrysler Jet Engine Plant.

• **The field of finishing** is becoming increasingly important and hydraulic drive and control are permitting better finishes. Z. C. Van Schwartz, Baldwin-Lima-

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Hamilton Corp. discussing a burnishing machine for working railroad journal bearings stressed the importance of infinite speeds and feeds available with hydraulics.

• **Pneumatics:** The pneumatic side of fluid power stands side-by-side with hydraulics, engineering-wise and design-wise. John T. Ellis, Hanna Engineering, presented the design factors for hydro-pneumatic shock absorbers. Foxboro's Claude D. Young reviewed pneumatic controllers and looked at some of the newer developments to include hydraulic components for meeting industrial requirements of greater sensitivity, faster response and ruggedness.

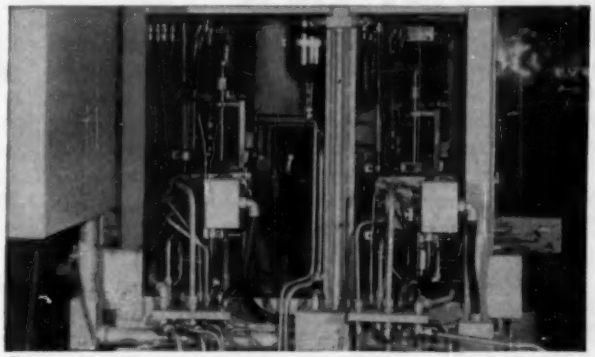
Such developments as the Bureau of Standards research and development contract for the Bureau of Aeronautics, which has come up with basic design parameters on air valves, and the work being done by at least two major airframe companies on primary pneumatic power and control systems for new aircraft, are evidence of the stimulation which pneumatics has received in the past two or three years.

• **Hydraulic fluids:** "Let's evaluate Hydraulic Fluids and Find Out Where We Stand" might have been another title for the two papers presented at the hydraulic fluids session. Fortunately, the two papers were planned with one man presenting the hydraulic fluid suppliers' viewpoint, the other the hydraulic equipment designer's viewpoint. While it is true that the latest studies in high temperature fluids and some of the research and testing of new synthetic fluids were only touched upon, the two papers added up to a practical evaluation of the present development and possibilities of hydraulic fluids. It was developed in the discussion that only one percent of hydraulic fluids in use today are fire-resistant.

Another significant phase of thinking caught our attention—machine and equipment designers now consider it necessary to know a lot more about the hydraulic fluids that are to be used in their machines than they did ten—or even five—years ago. This, in turn, has been helpful to the hydraulic fluid suppliers. Although their problems are tougher, they are at least spelled out by the user.

• **Aviation and the thermal barrier:** Temperature requirements have taken a sudden and tremendous jump. From a top temperature requirement of 160 F, there has been a leap to 275 F, followed by other requests for equipment and materials to meet 400 F, 600 F and even higher.

This situation made the paper on "Considerations in the Design of High Temperature Aircraft Hydraulic Pumps" by J. A. Mileti, of very considerable interest. In addition to the metallurgical, machining and assembly problems, there are the spectors of the high temperature, high pressure requirements on hydraulic fluids and seals. Something is being done about the last two critical problems in particular. As the discussion at the October meeting of A-6 clearly indicated, the packing industry is making a tremendous effort to meet the requirements.



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ASTM GOES TO WORK ON FLUID STANDARDS

• **Performance standards:** The American Society of Testing Materials has established a hydraulic fluids technical committee to prepare standards for petroleum and synthetic hydraulic fluids. These standards will deal with performance of fluids, not their composition. The group working on this project is known as Committee N. It is working under the ASTM Technical Committee D-2 on Petroleum Products and Lubricants.

The decision to establish Committee N was made at a preliminary conference in June. The first meeting of Committee N was held October 4th in Washington.

• **Who's on the committee:** Chairman is H. F. King, Bureau of Ships, U. S. Navy; Leo W. Manley, Socony-Mobil Oil Company is vice-chairman and W. H. Millett, Carbide & Carbon Chemicals Company is secretary. These officers were nominated by a Steering Committee which was appointed at the June meeting and were unanimously approved by the Advisory Committee of ASTM D-2. The Steering Committee included: Kenneth Court, Vickers, Inc.; R. E. Hatton, Monsanto Chemical Company; J. R. Hemeon, Ternstedt Division, General Motors Corporation, G. R. Keller, North American Aviation; Bernard Rubin, Wright Air Development Center, Mr. King, Mr. Manley and Mr. Millett.

R. E. Hatton will act as chairman of an organizational Advisory Committee that will make recommendations for organization of the new committee prior to the next ASTM meeting in February. The Organizational Advisory Committee is composed of the officers, members of the Steering Committee and eight additional persons appointed by the chairman.

• **Six fields of interest:** At the October meeting, short prepared papers were presented to outline fluid performance requirements in aircraft, industrial non-hazardous, industrial hazardous, mobile, servomechanisms, and naval applications.

• **Hazardous industrial applications:** J. R. Hemeon listed qualities of fire-resistant fluids which require study. He stressed ten qualities: fire-resistance, toxicity, lubricity, viscosity, viscosity index, foaming, thermal stability, pour point, compatibility with seals, gaskets and hose, and effect on paint.

It was also pointed out that the question determining useful life of a fire-resistant fluid is still open. To determine when to change a petroleum base oil, it is customary to evaluate Conradson carbon content, acid neutralization number, viscosity, and cleanliness. There is no comparative or complete quality control schedule for any of the four basic types of fire resistant fluids. These four types are: glycol water base, synthetic chemical compounds, homogenized water-in-oil, and emulsified oil-in-water.

• **Non-hazardous industrial:** Performance requirements for petroleum base fluids were discussed by R. Q. Sharpe. Most hydraulic applications in this field are at pressures below 3000 psi. Reservoir temperatures seldom exceed 150 F with system hot spots probably reaching temperatures of 200-250F. Well designed systems are relatively clean although some contamination with dirt and moisture occurs. In this field basic requirements of the fluid are: suitable viscosity at start up and at the operating temperatures, high oxidation stability, anti-wear protection, rust protection, demulsibility, and foam resistance.

"With the possible exception of viscosity index," Mr. Sharpe said, "these characteristics have been developed to a degree that is generally satisfactory." ASTM testing procedures for measuring physical characteristics of petroleum fluids for industrial service have wide acceptance. Results are good except for a lack of correlation between existing tests for demulsibility and the actual water separating ability of a product in service.

There is a big void when it comes to performance tests. Present ASTM laboratory tests for oxidation resistance, rust, and wear show little correlation with actual performance. Sharpe said that oil companies and users have set up a typical oil hydraulic circuit to evaluate relative performance of hydraulic fluids through observations of deposit formation, pump wear and oil condition. Sharpe's conclusion is that the committee could perform constructive work in a study of simulated field test procedures.

• **Aircraft fluids:** To help define the area of study of aircraft fluids, Bernard Rubin pointed to the operating temperature ranges: –65 to 275F, –65 to 400F, and ranges over 400F. Properties, which are considered important, change in relative importance depending on the temperature range of the fluid. Reliability and significance of tests becomes less and less certain as the temperature

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goes up. Fluid developments in this high temperature field are new and many are in preliminary stages. Therefore, a study of performance characteristics of fluids in this field must start pretty much from "scratch". Unlike the industrial field, there is no great backlog of user experience to draw on.

• **Special for servos:** While fluids for servo systems should possess the standard desirable qualities specified for use in aircraft hydraulic systems, they should also possess several special qualities. These were discussed by L. B. Taplin. Bulk modulus determines static rigidity of the system and influences the amount of gain or amplification which a servo can use. Because entrained air affects the bulk modulus, foam resistance takes on added importance. Lubricity is important because low friction is necessary for system accuracy as well as part life. Stability of a servo system requires a fluid with a high viscosity index. For many servo systems an oil having a low specific gravity is important when considering the natural frequency of the servo.

It is desirable that the servo fluid in a closed loop installation possess a high heat coefficient and a high heat transfer coefficient so that a loss in energy will result in minimum temperature rise and a maximum amount of heat can be rejected from the fluid.

• **Mobile equipment:** The need for improved test methods to characterize hydraulic fluids used in automotive mobile equipment for fluid couplings, torque convertors, automatic transmissions and "off-the-highway" road construction and industrial service was discussed by H. R. Wolf. He pointed out that fluids now being used fall into four viscosity ranges; namely, 1.5 centistokes at 210 F; 3.6 to 5.0 centistokes at 210 F; 50 SUS at 210 F; and the SAE 20 or SAE 30 motor oil range. Additional standardization is needed to define such hydraulic fluid properties as oxidation resistance, anti-

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8	25	42	59	76	93	110	127	144	161	178	195	212	229	246	263	280	297	314	331
9	26	43	60	77	94	111	128	145	162	179	196	213	230	247	264	281	298	315	332
10	27	44	61	78	95	112	129	146	163	180	197	214	231	248	265	282	299	316	333
11	28	45	62	79	96	113	130	147	164	181	198	215	232	249	266	283	300	317	334
12	29	46	63	80	97	114	131	148	165	182	199	216	233	250	267	284	301	318	335
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14	31	48	65	82	99	116	133	150	167	184	201	218	235	252	269	286	303	320	337
15	32	49	66	83	100	117	134	151	168	185	202	219	236	253	270	287	304	321	338
16	33	50	67	84	101	118	135	152	169	186	203	220	237	254	271	288	305	322	339
17	34	51	68	85	102	119	136	153	170	187	204	221	238	255	272	289	306	323	340

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friction characteristics, low temperature viscosity, anti-foaming characteristics, and the effect of the fluid on seals.

• **Naval problems:** The Navy's current interest in the development of improved hydraulic fluids for shipboard service was outlined by J. R. Belt. He stated that the Navy is particularly concerned with the resistance to ignition offered by various types of hydraulic fluids and expressed the opinion that an ASTM committee could be helpful in developing standard flammability test procedures. He pointed out that the Navy is currently studying compression ignition characteristics, the effect of compressed air shock waves, and the spray flammability properties of different fluids. Another major problem that is pertinent to the activities of the new committee lies in the area of determining the lubricating properties of hydraulic fluids in conjunction with the wide variety of pumps, valves and miscellaneous hydraulic equipment with which they are used. ▼▼▼

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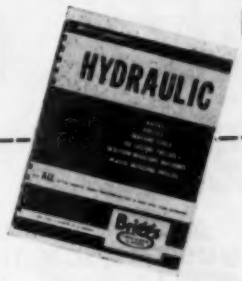

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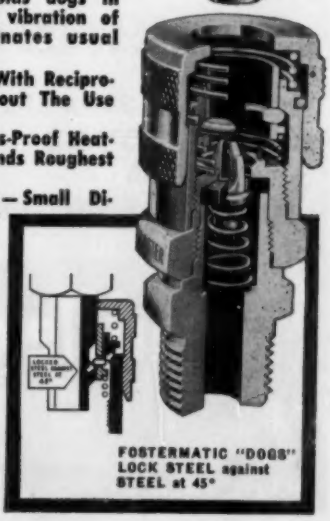

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Ideas from a Sales Engineer

Elmer F. Heiser

During Elmer Heiser's 18 years of selling air and hydraulic components, he has solved many problems and has left some unsolved. He is the author of the recently published book *"Air and Oil Cylinders in Industrial Applications"*. Because we enjoy learning of Elmer's experiences and opinions, we've asked him to write these monthly columns.

Check Your Oil?

THERE are a number of subjects which pop up frequently in so-called man-talk conversations. In our gang of fishing hoodlums, should we run dry on fishing fabrications or mother-in-law discussions, the conversation quite often turns to the relative merits of automobiles.

On this topic, as with most others, the last liar always has the advantage. Each claims that the car he drives uses litle gas and no oil. One even leaves the cap off the gas tank over night occasionally to allow excess gas to evaporate.

Honest answers among such lying fishermen friends are impossible, but strangers we can sometimes believe.

The other day, while engaged in conversation with a stranger, the subject of cars came up. He was driving a model, which one of the honest fishing friends claimed never used oil, so it seemed like a good chance to get the facts. Unfortunately he confirmed the lie, stating that though the car had run over 33,000 miles he never adds oil between oil changes.

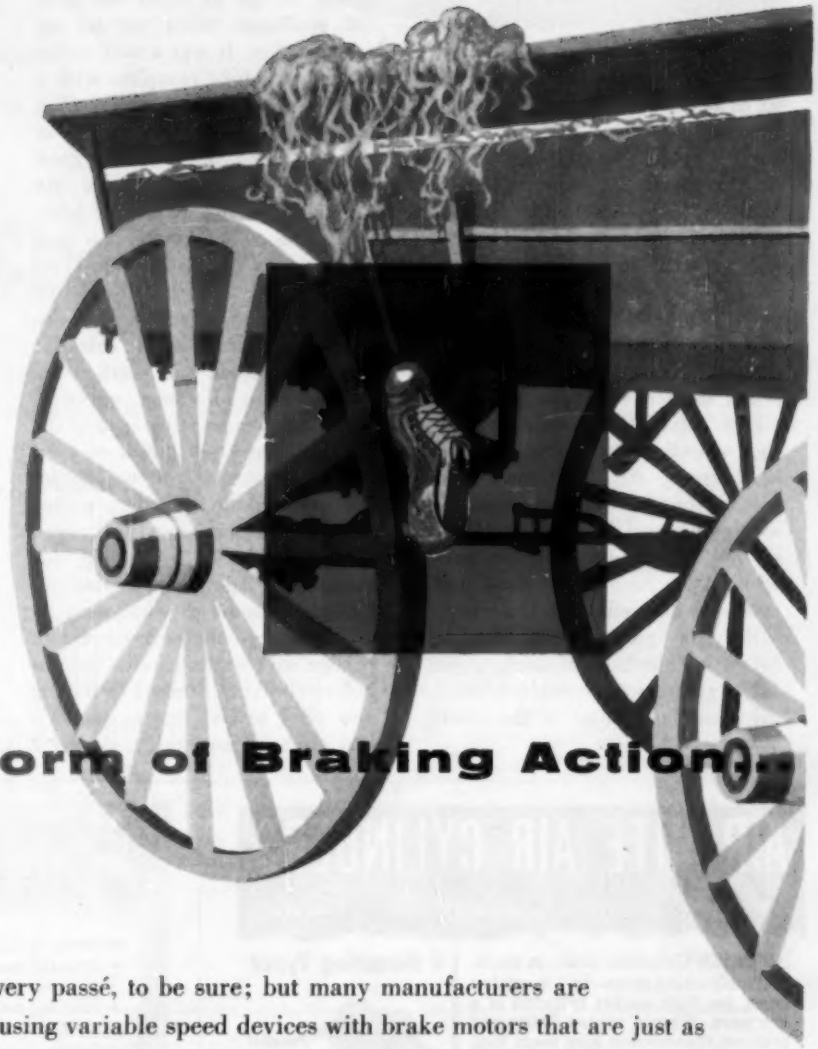
Further conversation revealed that he has the oil changed every 500 miles. No wonder he never adds between changes. Probably sets 35 mph as his top speed too.

Why, with a modern car, equipped with a filter and with today's oil developed specifically for its purpose, should he change every 500 miles instead of every 1500 or 2000 miles.

Occasionally when we get mixed up with a new piece of hydraulic equipment we are asked about the recommended frequency of oil changes. "How often should we change the oil in the hydraulic system?"

A few times I tried to establish a time period for a new user, but found that it was easy to miss. You consider reservoir size; operating pressure and frequency; whether the system will run infrequently or 24 hours a day; general shop conditions as they indicate know-how and house-keeping; the caliber of maintenance and operating personnel, etc. In one case after an "intelligent" appraisal, the time for oil change was guessed at 12 months. Three years later the chief engineer recalled this early recommendation and advised that the original oil was still in good condition and that approximately five gallons of

Continued on page 100



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. . very passé, to be sure; but many manufacturers are using variable speed devices with brake motors that are just as out of date and ineffective as the junk man's old shoe.

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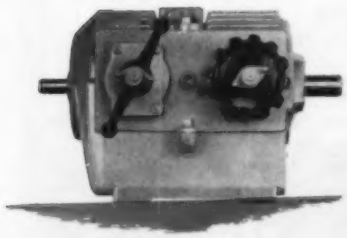

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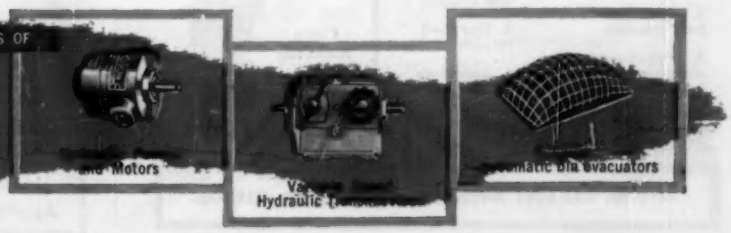

new oil had been added in the interval.

Another time when conditions looked less favorable a time period of 8 to 10 months was recommended. Inside of three months, however, the pump had chewed itself to pieces. In this case it was impossible to foresee that a boy mechanic would "string" the piping and that any leaks would be "fixed" by hanging cans to catch the drippings. It would also be impossible to know in advance that these hanging cans would prove attractive targets for used cigars, cigarettes, chewing tobacco, miscellaneous parts, broken sand cores, etc. Nor could one foretell that the same boy mechanic would dutifully and regularly go his rounds dumping the contents of the cans into a dirty pail using it to refill the reservoir. When the pump went bad we found a collection of sand, cigar butts and assorted rubbish piled thick in the bottom of the reservoir.

How often the oil is changed would seem to depend somewhat on how it is used and abused.

This brings to mind our first real appliance when we set up housekeeping. It was a mail order washing machine complete with a book of instructions. Regarding oil, the book said "Drain oil in gear case and refill with a good quality SAE 30 oil every six months". Having paid the fabulous price of $27.00 for the machine we intended to follow instructions to the letter to protect the investment. We hung the instruction book with a calendar over the washer and marked the date when an oil change was due. When oil change time came, the oil we drained out looked as good as the "expensive" oil we put in. We marked the calendar, waited six months and again went through the procedure of protecting our investment. Again what came out looked the same as what went in.

We skipped the next six month change and waited twelve months before checking. Instead of buying new oil I looked first to see if it had changed noticeably. Again it looked and felt the same as new oil. You know it was eighteen years before we changed again and then we changed the old machine for a new fangled one. This change was not due to mechanical failure but rather social pressure. My wife was the only one in the neighborhood who couldn't push a button, then watch television, while the clothes washed, rinsed and "wrang" themselves.

The above isn't intended to imply that any established program for oil changing is wrong. The whole thing points out two facts only:

1. There's a relationship between the condition of the oil and the use it gets.
2. There's a better way to find out when to change oil than by asking one hydraulic equipment salesman.

About that first washing machine. Maybe those instructions were for the guy whose wife had to run it 'round the clock to make enough money so he could spend his time fishing with his lying friends. ▼▼▼

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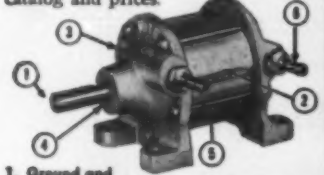

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Use Parker hydraulic accumulators for less maintenance, longer life

- Piston type . . . compact.
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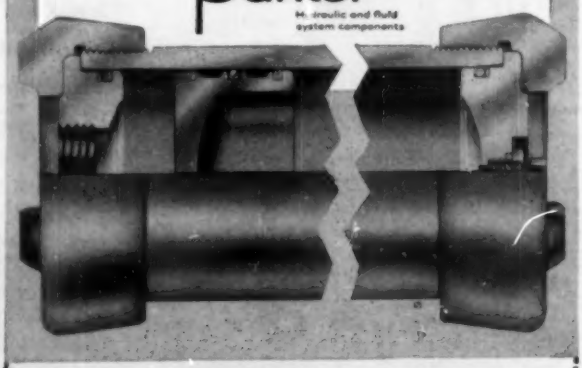
Hydraulic and fluid system components



Order from your Hydraulics Jobber—or Industrial Hydraulics Division, Section 251-R, Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio

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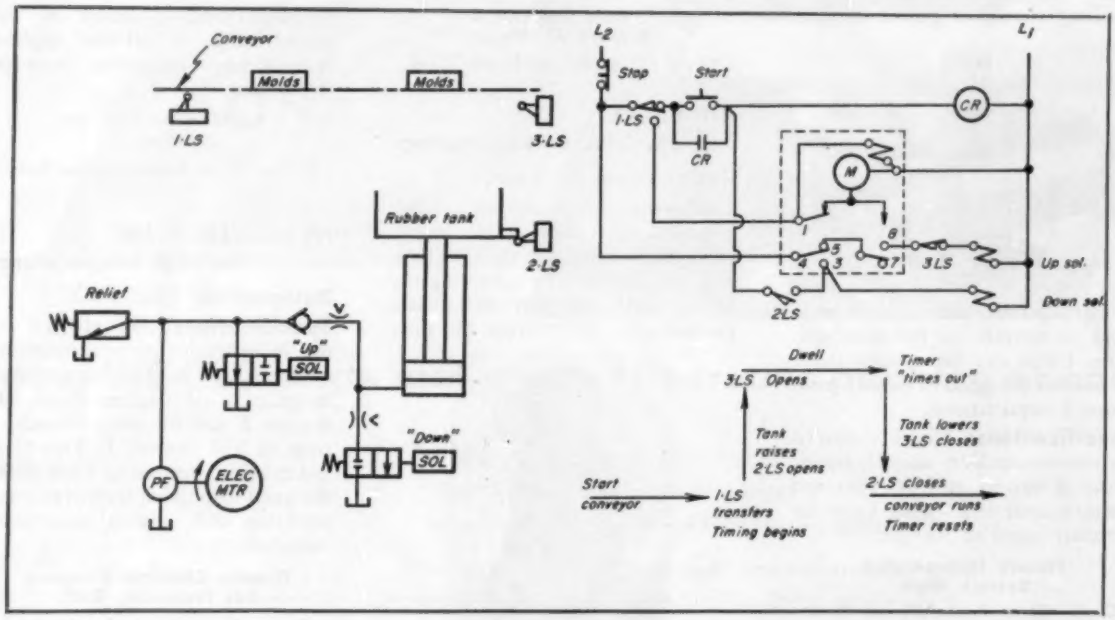
Although a child's balloon
never seems to last longer than 30 minutes,
quality as well as quantity
is an important consideration.
To obtain uniform thickness, circuits are designed to give . . .

Problem Clinic

TIMED CYCLE FOR TOY BALLOONS



• By M. G. Saake

TOY balloons are an inexpensive, mass produced item which require automatic processing equipment. On conveyorized production equipment, built by Frederick T. Apted Co. Uniondale, New York, thickness of the rubber coating on the molds is determined by a timer controlled hydraulic lift cylinder. Quality of the product depends on the coating thickness—uniformity is of course required.

Balloon molds are placed on racks and these racks are put on a motor driven conveyor. The control circuit for this equipment automatically starts and stops the conveyor to position each rack over a rubber tank. The 600 pound tank is raised 12 inches in about 20 seconds by an oil driven, single acting piston. A timer is set to cause the lift cylinder to dwell at the top of the stroke so that a controlled thickness of rubber is deposited on the molds. Any dwell time up to 150 seconds can be selected.

After the dwell, the tank lowers in about 30 seconds. Needle valves in the hydraulic circuit permit adjustment of raising and lowering speeds. With the tank fully lowered, the conveyor starts up again and the cycle continues to repeat until the stop button is pushed.

The electrical and hydraulic circuits and the motion diagram clearly illustrate how the control is set up. To save power, the hydraulic circuit is arranged so that the pump only delivers oil at pressure when the tank is being raised. During dwell, at the top of the stroke, the pump is unloading and the tank is held up by trapped oil. Release of this trapped oil permits lowering by gravity.

This simple "up", "dwell" and "down" motion, tied in with a conveyor is common to many processes throughout industry. ▼▼▼

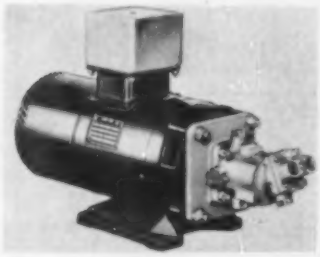
New Products continued

MOTORPUMPS

. . . for aircraft hydraulic systems

Designation: Model AA-19033

Features: This new line of electrically-driven hydraulic pumps have high overall efficiency and low input amperage, and a very low heat rejection factor. Unit is designed for use as an independent, auxiliary source of power or as a



primary power source in remote areas in aircraft oil hydraulic systems. Units can be custom made accessories designed to exactly meet a user's requirements.

Specifications: Model shown is for continuous duty use. Hydraulic pump is driven at 7500 rpm and has an output of 2.5 gpm. Units are normally rated at 300 psi.

Vickers Incorporated
Detroit, Mich.

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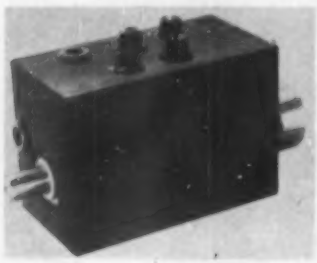
SERVO CONTROL VALVE

. . . has rectangular internal ports

Designation: Model CO-5

Features: All hydraulic connections are grouped on top of the



valve so that multiple installations operated by a number of cams or linkages will occupy as little space as possible. Valve is designed for use in follow-up positioning systems where mechanical input signals are obtained from cams or linkages. Positional feedback is obtained through the use of differential input linkages or by displacing the valve body relative to the spool motion. Valve flow vs. displacement characteristics are easily modified to suit individual power and stability requirements.

Hydraulic Controls Co.
Roxbury 20, Mass.

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AIR VALVE

. . . operates without springs

Designation: S-3 Series

Features: 3-way solenoid pilot-operated valve is of simple design. All internal parts are readily accessible in the valve by removing the bottom nut. Unit provides fail-safe performance. By rotating the pilot

head the valve can be used normally open or normally closed. Solenoid has a low amperage solenoid coil which operates on most AC and DC voltages and directs only two internal moving parts, spool and solenoid plunger.

Specifications: Valve has a full pipe capacity with operating pressure from 30-150 psi. It can be mounted in any position. Lead length of 24 inches is provided.

Applications: Suitable for use on air clutches, air brakes, power feeds and other pneumatic equipment.

Airmatic Valve Inc.
Cleveland, Ohio

Circle 123 on Reader Service Card

PULL TYPE AIR CYLINDER

. . . for clevis mounting

Design: Compact, ruggedly built cylinder has non-rusting cylinder heads, bronze oilless ram bushings, synthetic piston cups and custom

designed return springs. New model has a standard length stroke of 1½ inches but longer stroke cylinders are available. Ram extension is optional to meet the user's specific requirements.

Applications: Cylinder is designed for use in "off-line" applications or where movement in an arc is required.

Air-Mite Devices, Inc.
Chicago, Ill.

Circle 124 on Reader Service Card

HYDRAULIC FLUID

. . . for high temperatures

Designation: Fluid 8515

Specifications: Developed for use in hydraulic systems operating continuously in the temperature range of —65 degrees F. to 400 degrees F and for short periods of time to 550 degrees F. This fluid is a modified version of Fluid 8200, designed to provide improved compatibility with existing elastometer materials.

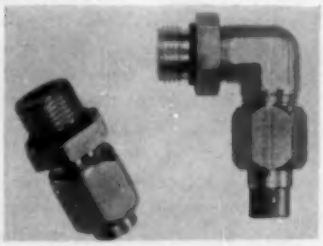
Oronite Chemical Company
San Francisco, Calif.

Circle 125 on Reader Service Card

TUBE FITTINGS

. . . with straight thread mounting

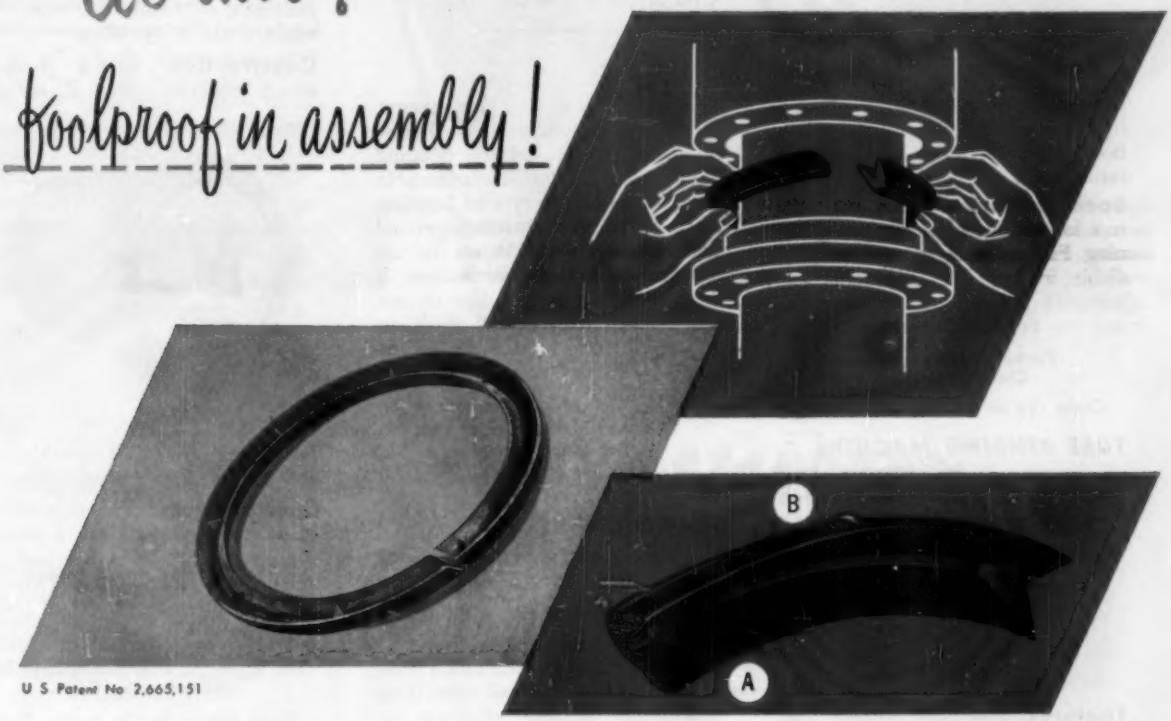
Features: Designed to overcome tapered pipe thread leakage prob-



lem in high pressure hydraulics, these straight thread fittings use O-ring sealing. The fitting is also

Continued on page 104

At last! a really leakproof ring that is foolproof in assembly!



U S Patent No 2,665,151

Linear VEE-DAM rings make other hydraulic packing obsolete

NO OTHER PACKING DESIGN has ever done it! But now LINEAR assures split V-Ring packing that's absolutely leakproof, regardless of the fit at the ring joints!

Even when gaps occur, through careless assembly or variations in bore size, LINEAR VEE-DAM RINGS completely eliminate labyrinth flow. Sturdy rubber dams (A) in the grooved hinge area of each ring hermetically seal center groove sections when rings are stacked together. And lateral leakage is prevented by external abutments (B) on ring shoulders.

LINEAR VEE-DAM RINGS save on installation and maintenance . . . last longer . . . reduce down time. They're the first real achievement in hydraulic packing design for a quarter century. We're molding them in a variety of sizes and compounds to meet extremes of temperature and pressure.

GET ALL THE FACTS NOW!

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

New Products continued

shorter, eliminating the danger of the unit protruding into the valve body thus interfering with an internal element.

Specifications: Elbows and tees have a locknut for adjustable positioning. Fittings made in steel are available in both the Triple-lok standard JIC 37 degree flare type and the Ferulok flareless type.

Parker Appliance Co.
Cleveland, Ohio

Circle 126 on Reader Service Card

TUBE BENDING MACHINE
. . . for ferrous and non-ferrous tubes

Features: This light, portable unit consists mainly of two components, the frame in which the hydraulic pump is located and the bending arm which houses the adjustable back roller. A new type of bending head fits onto the hand-operated self contained pump. With the use of correct formers this machine is capable of bending tubes of not less than 18 gauge wall thickness and up to 3 inch diameter to any angle up to and including 180 degrees.

Chamberlain Industries Ltd.
London, England

Circle 127 on Reader Service Card

TIME DELAY RELAY
. . . has ¼ of 1 percent repeat accuracy

Designation: Type 412, motor driven

Features: Design provides a multiplicity of external load connection possibilities without affecting internal wiring, and further flexibility is obtained through different internal contact arrangements. Setting mechanism provides quick, easy adjustability over full dial range, even while timer is operating.

Construction: Bakelite housing which encloses timer is securely

held by an O-ring. Removing ring and sleeve exposes entire rear.

Specifications: Timer is offered in 14 time ranges from 6 seconds through 24 hours, in 115 and 220 volts, 25, 50 and 60 cycles. This unit is interchangeable with its predecessor Type 410.

The R. W. Cramer Company, Inc.
Centerbrook, Conn.

Circle 128 on Reader Service Card

Compact NEW GAST rotary No. 6 AIR MOTOR delivers

TWO HORSEPOWER
. . . weighs only 17 pounds

Here's compact, light-weight power with many advantages as original equipment or for plant use! With this new 2 h.p. Model 6AM, the Gast line of rotary air motors now includes five popular sizes from 1/20 h.p. to 4 h.p.

Some models are available with either foot or flange mountings for horizontal or vertical direct, belt, or gear driving . . . special reversible rotation, etc. Gast Air Motors are *explosion-proof, variable-speed, burn-out proof* and *low in first cost!*

Write for Model 6AM Bulletin 855 (or specify h.p. that interests you) *and request "Application Ideas" Booklet also!*

Gast Manufacturing Corp., Box 117-D
Benton Harbor, Michigan.

Original Equipment Manufacturers for Over 25 Years

GAST ROTARY
• AIR MOTORS TO 4 H.P.
• COMPRESSORS TO 30 P.S.I.
• VACUUM PUMPS TO 28 IN.
See Our Catalog in Sweet's Product Design File

MAYSON HOSE SWIVELS

DO YOU HAVE THAT "SPIDER LOOK" ON YOUR MOBILE EQUIPMENT?

Mayson Hose Swivels go with flexible power. Mobile equipment such as loaders, stackers and conveyors all use Mayson Hose Swivels to provide shorter length, longer life, strain-free hoses. If your application seems difficult send the problem to us—we have a file of solutions to hose problems.

Mayson Hose Swivels are available from hose dealers in all parts of the country. Catalogue and your nearest dealer's name on request.

J.I.C. Standards
Sizes ¼" to 2" P.T.
Male or Female

MAYSON MFG. CO.
4332 Horatio Street • Detroit 10, Mich.

Circle 38 on Reader Service Card

Circle 62 on Reader Service Card

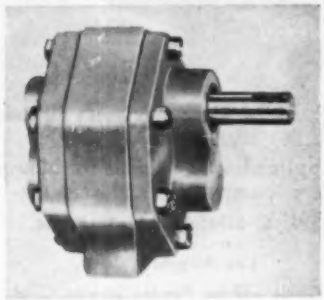
HYDRAULIC PUMPS

. . . rated for 1000 psi continuous duty

Designation: S Series

Features: Engineered for rugged industrial usage, these gear type pumps are made in five sizes, with discharge capacities from 8 to 22 gpm. The pumps are available in a variety of flanges, mountings and porting.

Applications: Recommended for use on truck mounted equipment,



road building machinery, material handling equipment, automotive products and many other types of mobile and stationary equipment.

Wisconsin Hydraulics, Inc.
Milwaukee, Wis.

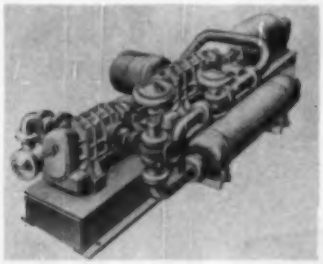
Circle 129 on Reader Service Card

TWO STAGE COMPRESSOR

. . . assures oil-free air delivery

Designation: Standardaire

Features: This new intercooled compressor includes a pair of posi-



tive displacement, axial-flow blowers, arranged to work in two stages to boost discharge pressure up to anywhere in a normal range of from 15 to 50 psig. Each blower has intermeshing male and female rotors which compress the air in the pockets that form between the lobes and grooves during the rotation of the two rotors. For air service the compressor is equipped with labyrinth seals, for gas service with mechanical seals.

Specifications: The compressors

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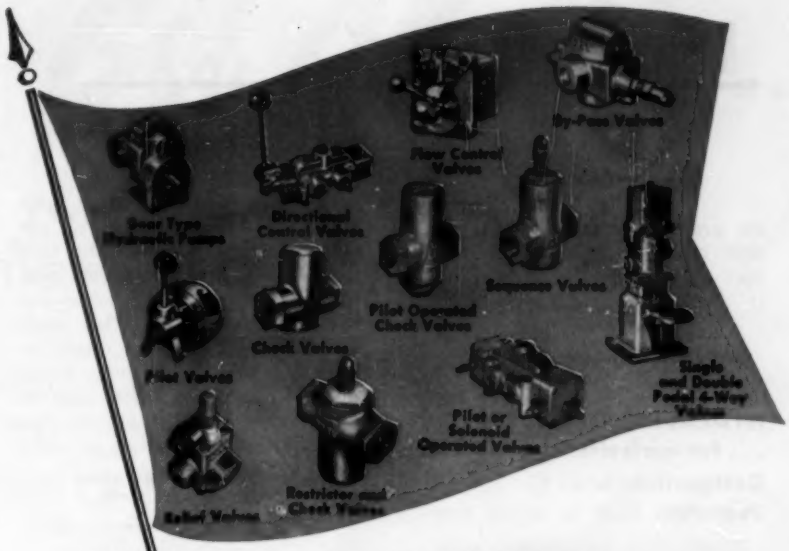


BY ANY STANDARD...

ADEL *Refinements* assure Plus Performance for Your Equipment

Designers and Engineers have set these standards for Industrial Hydraulic Equipment

Rugged simplicity • Long life • Simplification of piping • Reduced installation costs • Greater accessibility for maintenance • Completeness of line • Over-all economy

ADEL brings them all to you!

Smooth economical hydraulic power for Pushing, Pulling, Lifting, Pressing, Clamping and Controlling.

Illustrated are but a few of a wide variety of ADEL industrial hydraulic control equipment that offer definite benefits to both the user and builder of machine tools and many other kinds of equipment. ADEL products incorporate proven design and precision construction features that assure dependable operating efficiency over the years. A complete line for every application. You can simplify your Hydraulic Power Motion Problems by specifying ADEL.

A FEW SELECT TERRITORIES ARE STILL AVAILABLE TO PROGRESSIVE DISTRIBUTORS OF INDUSTRIAL HYDRAULIC CONTROL EQUIPMENT. INQUIRIES INVITED

For complete engineering specifications and counsel, Address: ADEL DIVISION, GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, Calif.

ADEL
PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

Manufacturers of Industrial Hydraulic Control Equipment

DISTRIBUTORS: AIR-DRAULIC EQUIPMENT CO., HOUSTON, TEX. • AIR & HYDRAULIC ENGINEERING CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND 14, ORE. J. BOYD COATES, GLENSIDE, PA. • CORBY SUPPLY COMPANY, ST. LOUIS, MO. • FRANK T. DONNELLY COMPANY, PITTSBURGH 38, PA. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE 4, CALIF. • HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO 7, CALIF. • AIR-DRAULICS COMPANY, PHOENIX, ARIZ. • INDUSTRIAL AIR & HYDRAULIC EQUIP. CO., DETROIT 15, MICH. LINCOLN SUPPLY COMPANY, PROVIDENCE, R. I. • L. H. MONSEES, INDEPENDENCE, MO. • THE NEFF ENGINEERING CO., FORT WAYNE 3, IND. • POWER DRIVES, INCORPORATED, BUFFALO, N. Y. • SCOTT EQUIPMENT & ENGINEERING CO., DAYTON 10, OHIO • ROBERT TAYLOR & SONS, SALT LAKE CITY 10, UTAH • WYATT SALES COMPANY, CLEVELAND 15, OHIO TRI-STATE SUPPLY COMPANY, BROOKLYN 33, N. Y.

Circle 2 on Reader Service Card

New Products continued

are available from 100 to approx. 4000 cfm, ranging from 15 to 600 hp.

Read Standard Corp.
New York, N. Y.

Circle 130 on Reader Service Card

HYDRAULIC CYLINDERS
. . . for agricultural equipment

Designation: Series F

Features: Built to ASAE stand-

ards, these farm cylinders are designed for easy installation. The units include O-ring seals throughout, ground and polished hard chrome plated steel shaft with wiper seal, and seamless steel barrel burnished to a hardened mirror surface. Aluminum alloy front head and piston provides a rustless, nonscoring surface. Rear head is machined from solid steel bar stock.

Specifications: Stock sizes include 8 and 10 inch stroke length in 2, 2½ and 3 inch bore sizes for operation at 1500 psi. Special types and sizes can be supplied on order.

Modernair Corporation
San Leandro, Calif.

Circle 131 on Reader Service Card

AIRCRAFT MOTOR
. . . totally enclosed

Designation: Type SDVA

Features: Built of lightweight material, the motor is cooled by a fan which blows air over the ribs of the frame. Manufactured to applicable military specifications, this motor is also available as explosion-proof type SEVA.

Specifications: Unit weighs 6.5 lbs; delivers ¼ hp continuously at 5700 rpm, operating on 3-phase, 400 cycle, 208 volt alternating current. Starting torque of motor is

4.5. in-lbs while maximum altitude level is 50,000 feet.

Applications: Suitable for blower drive, pump drive and actuator.

U. S. Electrical Motors, Inc.
Aircraft Division
Los Angeles, Calif.

Circle 132 on Reader Service Card

SHUT-OFF VALVE
. . . for air or oil service

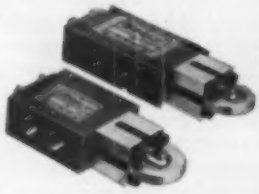
Designation: 900 Series

Features: This manual toggle operated valve provides leakproof

Continued on page 108

Modernair

CRV SERIES ROLLER CAM VALVES



NEW Compact, Easy-Mounting Design!

FLAT SURFACES ALL AROUND, with convenient access to ports (all ⅛-27 NPT) make new CRV series valves easiest to "design into" your application. Ultra-compact—4-way is only 3/4" x 1-1/2" x 4-3/16" overall (roller cam extended).

STANDARD "O" RING SEALS throughout assure long, reliable service, are easily replaced when necessary.

CRV SERIES VALVES now available in 3 or 4-way hand lever, palm button, foot control, cam, roller or pilot-operated types. Prices range from $11.30 to $15.95, f.o.b. factory.

NO OTHER VALVE offers all these important features —why settle for less? Call your MODERNAIR dealer or write today for complete data.

Modernair CORPORATION

Dept. B-12, 400 PREDA ST., SAN LEANDRO, CALIF.
Member National Fluid Power Association

Circle 66 on Reader Service Card

NEW! Speedy

1 TON *Heavy Duty* **AIR PRESS**

No. 80

only $85

★ Heavy grey iron casting, accurately machined surfaces.

★ Power factor—15 times air line pressure of 5 to 150 lbs.

★ Throat clearance to center of 10" diam. circle.

★ Ram clearance 0 to 5", stroke 5/8", table 5" x 5".

This useful, high quality No. 80 SPEEDY AIR PRESS is the last word in air power engineering—the result of 34 years of specialization in diaphragm compression. Extremely sturdy, it does dozens of jobs formerly handled by expensive presses—and does them more quickly, easily and economically. Operated by Speedy Foot Control, Hand, or Fingertip Valves. Order from your supplier or write direct.

Write for New Catalog of Speedy Air Tools and Accessories

W. R. BROWN CORP., 2655 N. Normandy Ave., Chicago 35

AIR TOOLS • AIR VALVES • AIR REGULATORS • FILTERS • COMPRESSORS

Circle 17 on Reader Service Card

Do You Get All This...

when you buy hydraulic packings and fluids?

- ☐ Compatibility—kind to each other
- ☐ One-source convenience
- ☐ On-time delivery, with adequate stocks of standard items
- ☐ On-the-job service—both design and application—by engineers trained in *both* packings and fluids

...you do when you specify HOUGHTON!

FIRST, because we have every type of packing you need including synthetic rubber, leather and the new Houghton-Developed rubber-impregnated leather packings.

SECOND, every type: Cup, flange, U, V, including O-rings, washers, discs and gaskets . . . for oil, air, water and gas applications for all pressures and for temperature up to 2000°F.

THIRD, we're the only packing manufacturer also supplying all types of hydraulic fluids . . . reinforced petroleum base oils . . . lubricant additives for water systems . . . and the new Houghto-Safe non-flammable hydraulic fluid.

MOREOVER, we give you complete engineering service to match Houghton quality packings and fluids. Ask the Houghton Man about it.

HYDRAULIC PACKINGS AND FLUIDS

. . . products of

E. F. HOUGHTON & CO.
PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO

Ready to give you on-the-job service . . .

WEAR-SAVERS THAT WON'T STEAL POWER

Hydraulic cylinder makers use Chicago Rawhide's Type G wiper seals for many reasons. Here's one: the special Sirvis leather wiper element holds its own lubricant—operates at low friction. This means negligible power loss. Another advantage: the Sirvis leather element will not trap grit and carry it—will not score the shaft. Years of dependable performance have demonstrated the ability of C/R Type G Oil Seals to exclude dirt, dust and moisture. They may be the answer to your problem, too. Write for your copy of "C/R Perfect Oil Seals."

C/R PERFECT Oil Seals

More automobiles, farm equipment and industrial machines rely on C/R Oil Seals than on any similar sealing device.

CHICAGO RAWHIDE MANUFACTURING COMPANY

1301 Elston Avenue OIL SEAL DIVISION Chicago 22, Illinois

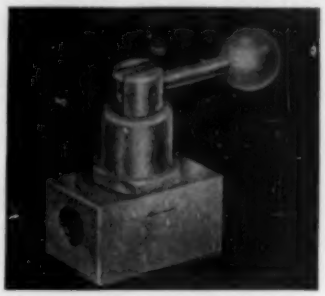
IN CANADA: SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO

Other **C/R** *products*

SERVENE (Synthetic rubber) diaphragms, boots, gaskets and similar parts for critical operating conditions • CONPOR: Controlled porosity mechanical leather packings and other sealing products • SIRVIS: Mechanical leather boots, gaskets, packings and related products.

New Products continued

shut-off. Immediate tight shut-off is achieved by the quick acting toggle lever operation. Perfect sealing is obtained by use of a resilient O-ring, protected from the fluid stream by a floating sleeve arrangement. The valve is held closed by the positive lock of the lever cam arrangement rather than by spring pressure.



Specifications: Unit is rated for pressures from O-3000 psi. The valve may be panel mounted.

James-Pond-Clark
Pasadena, Calif.

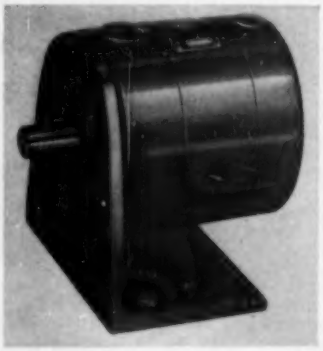
Circle 133 on Reader Service Card

HYDRAULIC PUMP

. . . for wide range of operating conditions

Designation: Series D

Design: A radial piston pump of simple design, it incorporates a new "shrink seal" feature. Simplified feed-back control with external valving can be utilized to accomplish variable displacement. The over-all efficiency is above 90 percent.



Specifications: Model D-5 (illustrated) is rated at 2000 psi maximum, 5 gpm at 1800 rpm.

Simplex Engineering Co.
Zanesville, Ohio

Circle 134 on Reader Service Card

FLEXIBLE HOSE

. . . withstands severe surge peaks

Designation: No. 1508

Features: This new hose is available in ⅜, ½ and ¾ inch sizes. It will perform at 5000 psi operating pressure in the ⅜ inch size

and at proportionate pressures in the larger sizes. The two larger sizes use the company's standard detachable, reusable fittings while a special socket has been designed for the ⅜ inch hose.

Aeroquip Corporation
Jackson, Michigan

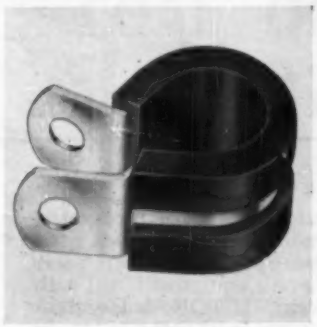
Circle 135 on Reader Service Card

CLAMPS

. . . made of silicone impregnated fiberglas

Designation: No. 82626

Features: A rugged heat and abrasion resistant clamp which will withstand sub-zero cold and intensive heat of aircraft, missile and rocket power plants. Temperature characteristics above +550 degrees F to below —90 degrees F. The clamps retain firm cushioned grip despite severe vibration. Cushions will not tear during engine harness assemblies.



Adel Precision Product
Huntington 4, W. Va.

Circle 136 on Reader Service Card

HYDRAULIC POWER PACKAGE

. . . features manifold mounted control components

Designation: Series T 8

Design: Units consist basically of

Continued on next page

DELIVERS LOW DRAG ON A HIGH PSI PISTON

Specifications demanded a difficult combination. The piston cups of this Midland Bus Door Engine must seal effectively pneumatic pressures ranging from 25 to 125 psi—and create minimum drag in a 6" stroke cylinder. While the cycles are relatively slow in bus door operation, they run as high as 100 per minute on other applications. Special C/R Conpor impregnated Sirvis leather cups provided the answer. Their high tensile strength, excellent resiliency and low sliding friction are particularly suited to applications such as this. After installation, the cylinders have given trouble-free operation . . . opening and closing city bus doors quickly, smoothly, day and night, winter and summer . . . even in long uninterrupted service. Perhaps C/R Sirvis-Conpor packings may solve a similarly difficult sealing problem for you. Get in touch with your nearest C/R Sales Engineer, or send for "Report on Conpor." Write A. P. Barth, Chicago Rawhide Manufacturing Co., 900 N. State St., Elgin, Illinois.

C/R conpor
CONTROLLED POROSITY
SIRVIS MECHANICAL LEATHER

CHICAGO RAWHIDE MANUFACTURING COMPANY

1301 Elston Avenue SIRVIS DIVISION **Chicago 22, Illinois**

IN CANADA: DISTRIBUTED BY SUPER OIL SEAL MFG. CO., LTD., HAMILTON, ONTARIO

EXPORT SALES: GHON INTERNATIONAL CORP., GREAT NECK, NEW YORK

Other C/R products

OIL SEALS: Shaft and end face seals for all types of lubricant retention and dirt exclusion • SIRVENE: (Synthetic rubber) diaphragms, boots, gaskets, and similar parts for critical operating conditions • SIRVIS: Mechanical leather packings and related products.

New Products continued

an electric drive motor, an oil-hydraulic pump and a control circuit mounted on an 8-gallon reservoir. Pumps and valves are direct connected to a common manifold

mounting panel, eliminating all external piping.

Applications: Recommended for a wide range of light industrial applications with systems requiring pressures up to 1000 psi.

Specifications: Three pump capacities are available, 2.2, 3.7 and 5.2 gpm rated deliveries at 1800 rpm and zero pressure. A choice of three electric drive motors rated 1, 1½ and 2 hp at 1800 rpm in combination with the three pump options provides flexibility for a variety of volume and pressure requirements.

Vickers Incorporated
Detroit, Michigan

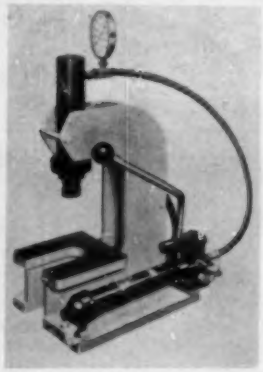
Circle 137 on Reader Service Card

ARBOR PRESS

. . . for pressures up to 5 tons

Designation: Staffa

Features: Construction employs steel sections so that the addition of jigs and other adaptors for specialized needs involves only a simple welding operation. Press is used in conjunction with a Hydroram pump and cylinder unit. Retraction of the cylinder after pressing is automatic and requires only a half turn of the release valve. Self-contained pump and cylinder unit is easily removable and provides a remote jack unit.



Chamberlain Industries Ltd.
London, England

Circle 138 on Reader Service Card

SOLENOID AIR VALVE

. . . pilot or manually operated

Features: Single solenoid 4-way

Continued on page 112

Get CONSTANT airflow at the CONSTANT pressure you need

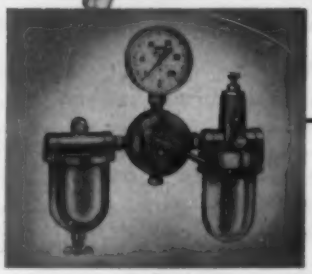
Use VICTOR Air Regulators

Reduce delivery pressures to required operating levels, prevent over-pressures, accurately maintain *constant* operating pressure and flow to cylinders, pneumatic tools and other air equipment—all without chatter. Standard model VICTOR Air Regulator has 0-125 p.s.i. delivery range, with 200 p.s.i. gauge. Other models with range to 250 p.s.i. (on request). Inlets are 500 p.s.i. (maximum). Temperature range, −40° to +200°F.

VICTOR Pneumatic Controls with VICTOR Air Regulator

For air-operated machinery and tools. Combines air regulator with filter and lubricator. Scientifically designed filter traps condensation, pipe scale and dirt from air line, with minimum flow resistance. Lubricator is set instantly to any rate, provides correct oiling for all types of air equipment; may be refilled without shutdown.

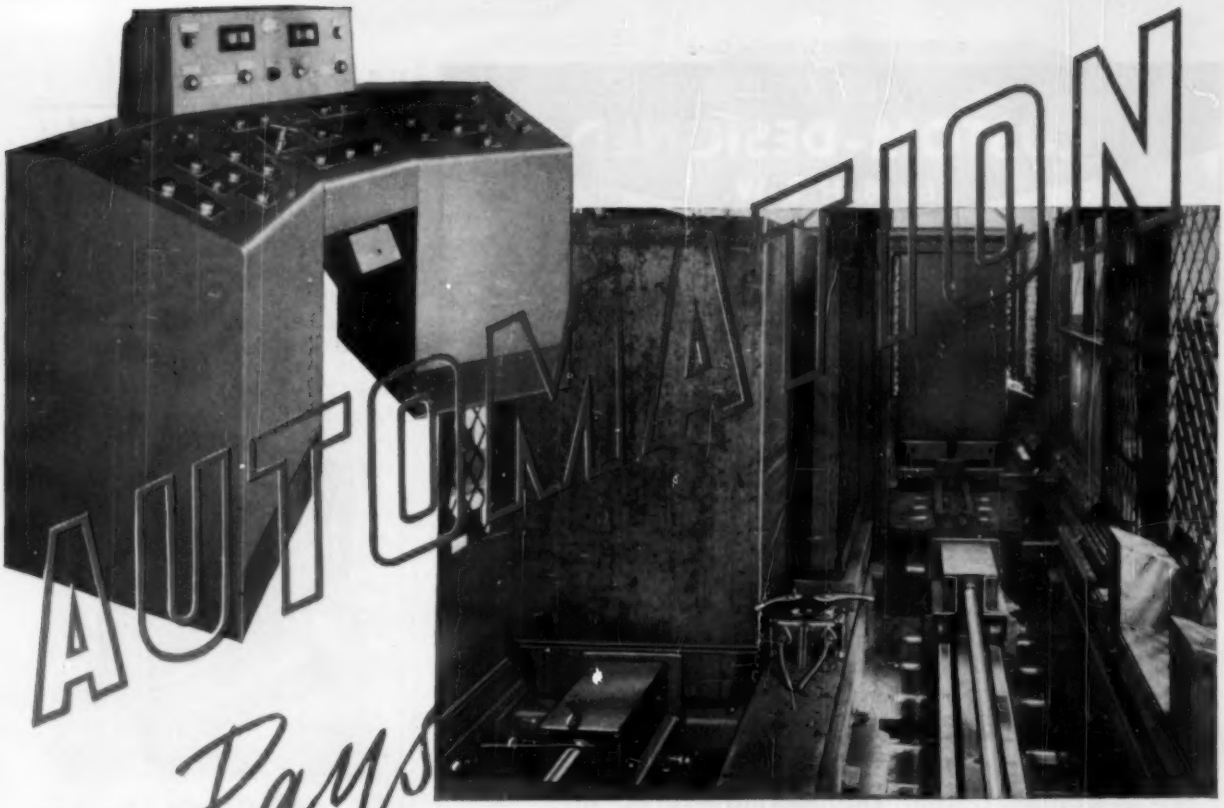
When regulating air or gases of any type, at any pressure from 0-10,000 p.s.i., look to VICTOR for highest quality instruments and expert assistance. See your VICTOR dealer now . . . or write for literature.



VICTOR EQUIPMENT COMPANY 27

Mfrs. of welding & cutting equipment; hardfacing rods, blasting nozzles, cobalt & tungsten castings; straightline and shape cutting machines.

844 Folsom St. • SAN FRANCISCO 7



Pays

COAL OUTPUT UP OVER 100%!

AT RAWDON

	BEFORE re-organisation	AFTER re-organisation	
MEN ENGAGED IN HANDLING			
ABOVE	66	8	MANPOWER BALANCE UPGRADED TO COAL-FACE WORK
BELOW	48	8	
NUMBER OF TUBS/CONTAINERS	650	6	INCREASED SAFETY WITH LESS MOVING MACHINERY
MAXIMUM TONNAGE PER HOUR	148.5	360	WOUND THROUGH ONE SHAFT INSTEAD OF TWO

THESE OUTSTANDING FIGURES—*reproduced by permission of the National Coal Board — illustrate the economy and efficiency of the Torley Container Automation powered and controlled by Keelavite Hydraulics at Rawdon Colliery in Leicestershire.*

Plan right with

Keelavite *hydraulics*

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

KEELAVITE ROTARY PUMPS & MOTORS LTD., ALLESLEY, COVENTRY, ENGLAND . . . . Telephone: Meriden 225-6

Canadian Agent: John Spotton Company Ltd., 21 Carson Street, Toronto 14, Ontario

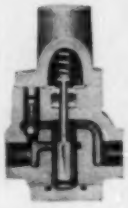
Circle 15 on Reader Service Card

HYDRAULIC CYLINDERS
CUSTOM-DESIGNED
by B.H.E.W.

Meet Your Product-Design Requirements.

Dependable performance in minimum mounting space is characteristic of B H E W hydraulic cylinders. Standard and special O.E.M. designs of all types, sizes and any mounting style are available on order . . . delivered on schedule.

Send specifications of your requirements for ANY kind of hydraulic, pneumatic and water cylinder.



BHEW

Lift trucks need the B H E W Pressure-Operated Hydraulic Flow Control Valve. It eliminates surge as load starts down. Load-weight controls rate of descent.

Benton Harbor Engineering Works, Inc.
St. Joseph, Michigan

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH

The New
CAPITAL HYDRAULIC OIL FILTER
WITH MONEL METAL INSERT
Reservoir Type for Hydraulic and Oil Re-Circulating Machinery
EASY TO INSTALL · EASY TO CLEAN · LONG LIFE · LOW COST
SIZES AND SCREENS TO FIT YOUR NEEDS

CAPITAL ENGINEERING & MFG. CORP.
5837 South Ashland Avenue Chicago 36, Illinois

New Products / continued

valve conforms to JIC standards. Solenoid is enclosed in dust-tight and watertight enclosure and mounted on the cover so that valve is electrically inoperative when cover is removed. Pig tail coil leads

are furnished with ring type pressure connectors and a built-in junction box is provided with a threaded electrical conduit connection,

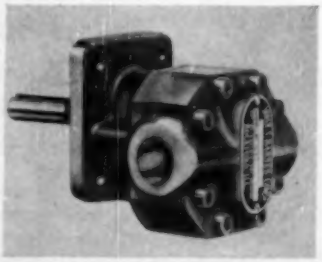
Sizes: Available in ¼, ⅜ and ½ inch sizes.

Automatic Valve Company
Farmington, Michigan

Circle 139 on Reader Service Card

FLUID MOTORS
. . . feature flow deflector pin

Features: Centering a deflector pin in the inlet stream of these gear-type hydraulic motors, has reduced turbulence. Modifications to the housing permit better starting



torque. Undersize bore and oversize shaft have reduced needle bearing clearances. The motor is available with speed reducer drive to insure very slow speeds when necessary. These motors are suitable for applications ranging to 2 hp.

The John S. Barnes Corp.
Rockford, Ill.

Circle 140 on Reader Service Card

Useful Literature / continued

SOLENOID VALVES . . . of general purpose, 2-way type are specified in Form No. V5004 issued by Automatic Switch Co. Features and application information data are presented, and cutaway photographs show operation of the normally-closed and normally-open types. Graphs are presented to show free air flow as a function of differential pressure at 25 psi and at 100 psi for various sizes of valves. A third chart shows liquid flow as a function of differential pressure. Charts show maximum pressures for air, water, and light oil service for each size valve. A dimensional drawing is included for the valves which are available in pipe sizes from 1¼ to 3 inches.

Circle 176 on Reader Service Card

V-BELT DRIVES . . . Multi-colored tables for quick and easy selection of constant speed Texrope V-belt drives are featured in a new catalog. This well illustrated 74 page booklet 20P40 available from Allis-Chalmers Manufacturing Company, also contains design features, basic drive principles and technical data on sheaves, also hints for economical, safe and dependable operation of V-belt drives.

Circle 177 on Reader Service Card

DRILL FEEDS . . . manufactured by The General Pacific Corp. are presented in a brochure from the company. These air operated, hydraulically controlled units operate at air line pressures from 80 to 150 psi and have an infinite range of variable-feed adjustment. The drill press spindle travel is 4 inches, and the spindle can be instantly returned at any point during the cycle. The automatic drill feed has a cycle of fast traverse to the work, hydraulically controlled drilling, and rapid return. The deep hole driller drills and retracts for chip clearance until the depth is reached, and incorporates an automatic shut-off.

Circle 178 on Reader Service Card

PNEUMATIC REGULATORS... including filter-regulator combinations, filters, regulators, relays, purge assemblies, and control panels are discussed in Bulletin H-2 from Conoflow Corp. The components are illustrated by photographs and cutaway drawings, and charac-

Continued on next page

FLEX-O-TUBE®

Supplied in Assemblies

Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

If pressure is a factor in the performance of your product, you can rely on Flex-O-Tube. For here is a name that has stood for uniformity of high quality for twenty-five years.

And just as important, the Flex-O-Tube organization is one that you can rely on, too. When the pressure's on for production you can count on prompt deliveries of flexible hose products that consistently meet specifications.

These are but two of the reasons why industry has used miles and miles of Flex-O-Tube and continues to specify it in increasing quantities. Why don't you find out for yourself by "putting the pressure on Flex-O-Tube"?

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.

Name .....

Company .....

City ..... Zone ..... State .....

Address .....

FLEX-O-TUBE

DIVISION OF MERIDAN CORP.

2527 JIM DALY ROAD • INKSTER, MICHIGAN

Flex-O-Tube Co. (Canada) Ltd., Windsor, Ontario

Useful Literature continued

teristics of the regulators are presented in graphs. Typical installations are indicated by schematic circuits, and features and design are contained in detailed discussions. Two applications of purge assemblies are outlined and illustrated. One of these is for the measurement and control of flowing fluids by means of differential meters when it is necessary to keep the fluid from coming in contact with the meter body. The other application is a system for obtaining liquid level indication by the bubbler system.

Circle 179 on Reader Service Card

MECHANICAL VARIABLE SPEED CONTROL . . . provides infinitely variable output speed over a range up to 9:1 from a constant speed power source. The Cleveland Worm & Gear Company, has an eight page catalog describing the features and operations of this unit. The operating principles are indicated in schematic drawings. Since this unit employs the rolling action of a series of balls, this device permits smooth adjustment of the output speed while operating under load.

Circle 180 on Reader Service Card

PORTABLE HYDRAULIC ROD CUTTER . . . powered from a 5-gpm pump is announced in a leaflet from Northcutt Mfg. Co. The 6000-psi pump is enclosed in a cabinet which has a hinged side for easy inspection. Low voltage control assures operator safety, and the unit is shipped completely wired and ready for service. The cutter has pressure lubrication to the moving parts and has only one moving seal. All-electric control is provided with a solenoid valve controlled by a control button.

Circle 181 on Reader Service Card

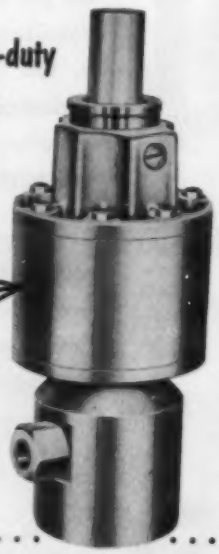
VALVES . . . for air, oil, and water service are specified in three brochures issued by Barksdale Valves. The air valves are available for 250, 2000, and 4000 psi service. Foot-operated as well as manual types are available for the 250-psi service while manual valves are shown in the higher pressure types. Dimensions, and valve characteristics including minimum flow passage, free air flow, and actuating force, are given for each type. The manual oil valves are for 1500, 3000, and 6000 psi service. 2-way and 4-way valves are available for 1500 and 6000 psi service and 4-way valves are available for 3000 psi service. Water service valves are available in 2-way and 4-way types for 3000 and 6000 psi service.

Circle 182 on Reader Service Card

ENGINEERING & RESEARCH FACILITIES . . . A two page brochure offered by Lester C. Hehn, Engineering and Research Development, describes the consulting services and research facilities in the fields of mechanical engineering and applied physics. Among the services currently performed are new product design, engineering reports, research and development, patent studies and model making.

Circle 183 on Reader Service Card

AT LAST! A heavy-duty air-operated Hydraulic Boost Pump with positive operation, high fluid capacity, and long life!



The new S.C. 10-304 Hydraulic Boost Pump has licked the problem of balky pump operation. A spring offset automatically positions the air actuating valve on the power stroke. This feature, plus an automatic sequence of operations, make it *impossible to stall or stop the pump*, assuring positive, continuous operation.

Simple, trouble-free operation—The valve assembly is made of corrosive-resistant steel, heat treated for long life.
Accommodates either oil or water—for both testing and powering of equipment.
Minimum air leakage—Both valve and sleeve are precision honed for closer fit; smoother operation.
Maintains desired pressure automatically—Operates often enough to replace any fluid which has leaked from the system.
Eight standard models—1000, 2000, 3000, 5000, 8000, 10,000, 20,000 and 30,000 p.s.i. All models operate on 80 p.s.i. air pressure.
Output capacities—From two gallons per minute at 1000 p.s.i. to 23 cubic inches per minute at 30,000 p.s.i.

Write for discharge curves and prices

SC HYDRAULIC ENGINEERING CORPORATION

8318 SO. CENTRAL AVENUE • LOS ANGELES 1, CALIFORNIA • PHONE LOGAN 5-5584

Circle 107 on Reader Service Card

LOOK TO CIRCLE SEAL FOR DEPENDABILITY

- CHECK
- RELIEF
- SHUT-OFF

LEAK PROOF VALVES

T-900 Series . . . Toggle Operated Shut-off Valve . . . Quick acting toggle lever operation with positive leak-proof shut-off. Fool proof, maintenance free, with no adjustments required. Snap it's open . . . snap it's closed . . . dead tight. For liquid or gas—for any pressure up to 3000 PSI. Operates smoothly and easily up to full rated capacity.

Representatives in Principal Cities
SEND FOR INFORMATION

JAMES • POND • CLARK

2181 East Foothill Blvd. • Pasadena 8, California

Circle 52 on Reader Service Card

HANDBOOK OF HYDRAULIC TABLES . . . and Other Engineering Data is the title of a publication made available by Aldrich Pump Co. This 28-page Bulletin No. 50 is a reference work for hydraulic engineers interested in pumping and piping problems.

Circle 184 on Reader Service Card

VALVE SELECTION CHART . . . designed for simplified selection of forged needle, bar stock, and toggle valves has been published by Hoke, Inc. The 18 x 24-inch wall chart presents tabular data on both vee-point and blunt-point needle valves as well as spring-closing and cam-closing toggle valves, all available in a choice of forged body or bar stock designs. The new wall chart also includes a Corrosion Resistance Table and formulaes for the proper method of valve sizing based on maximum flow desired.

Circle 185 on Reader Service Card

STEEL TUBING . . . is the subject of a new catalog describing four major classifications of carbon and alloy steel tubing including pressure tubing. This catalog issued by Ohio Seamless Tube Div. of Copperweld Steel Co. covers both seamless and electric resistance welded tubing, and tube fabricating and forging.

Circle 186 on Reader Service Card

HOSE COUPLINGS . . . for various applications are described and specified in Catalog AC-1154 released by Dixon Valve & Coupling Co. Each type is pictured, and sizes, applications, and prices are given. Featured are several types of air hammer couplings, air hose couplings, and hose menders. Single bolt and double-bolt hose clamps are also included.

Circle 187 on Reader Service Card

Coming
March 19-23
The best and latest in tools, machines, inspection equipment, automation devices, controls and accessories to cut costs and boost profits—many never before shown anywhere.
• For the small plant
• For the intermediate plant
• For the big plant
1956 ASTE INDUSTRIAL EXPOSITION
INTERNATIONAL AMPHITHEATRE
CHICAGO, ILL.
AMERICAN SOCIETY OF TOOL ENGINEERS
10700 Puritan Detroit 38, Michigan

Fast change-overs are easy on the new

NP Power Drive Cylinder

This cylinder has *all* the *most wanted* design features . . . provides exceptional adaptability, quick assembly and disassembly. You can make *many* fast change-overs using the simplest tools. Cushioning is easily adjusted; packing and internal parts can be changed; operation modifications can be made quickly on the *basic* cylinder.

No other cylinder offers so many vital features: compact, streamlined design; lightweight aluminum alloy and steel construction with *no* sacrifice of strength; sealed-in lubrication which eliminates need for external line lubricators. Operates with air, water or oil without interchanging or adding parts.

RATINGS: air — 200 psi; water or oil — 500 psi; Bore diameters: 1½", 2¼", 3", 4". Mountings: foot, flange, pivot, clevis, trunnion

NATIONAL PNEUMATIC CO., INC. AND HOLTZER-CABOT DIVISIONS

125 Amory St., Boston 19, Mass.
Sales Service Representatives in Principal Cities throughout the World

Designers and manufacturers of mechanical, pneumatic, hydraulic, electric and electronic equipment and systems

. . . Mail this coupon today for data sheets illustrating many other features . . .

INDUSTRIAL ACTUATORS AND CONTROLS DIVISION
NATIONAL PNEUMATIC CO., INC.
125 Amory Street, Boston 19, Massachusetts

Gentlemen: Please send me design information on the NP Power Drive Cylinder . . Include information on NP Power Check feed control — NP Power Trol valves —

Name.....
Title.....
Company.....
Street.....
City..... *Zone*. . . . *State*. . . .

Post Scripts of Industry

News about people, manufacturers and sales organizations

William J. Fath
The Hydraulic Press Mfg. Co.

Frederick L. Guyette
The New York Air Brake Co.

William Spangler
Resistoflex Corporation

Hydraulic Press Manufacturing Company has appointed **William J. Fath** as production control manager. Formerly production and plant manager for National Farm Machinery, Fath comes to H-P-M with a wide background of experience in factory operations.

Promotion of **Frederick L. Guyette** to chief plant and equipment engineer has been announced by **The New York Air Brake Company.** Guyette, after serving in various manufacturing capacities for 25 years with the company, will now be responsible for plant layout, machine tools, buildings and equipment for all five manufacturing divisions.

The A. W. Cash Co., Decatur, Ill., has purchased the **Farris Stacon Corp.,** Palisades Park, N. J. Operations of the Farris Stacon Corp. will be transferred to the Decatur plant. In the purchase, the A. W. Cash Co. acquired some special equipment, inventory, finished parts, engineering drawings, designs, patents and other assets.

The sales engineering staff of **Resistoflex Corporation** has been expanded in the Midwest with the establishment of a new sales office in Kansas City, headed by **William Spangler.** He will be responsible for the sale of the company's industrial and aircraft products. **M. H. Eberle** has been appointed sales engineer at the Chicago office.

Blackhawk Manufacturing Co. has sold its "Blackhawk" Hand Tool Line to **The New Britain Machine Co.,** New Britain, Conn. According to Philip G. Brumder, president of Blackhawk, the company will now be able to further expand and specialize in the broadening fields of hydraulic products and lifting equipment. Blackhawk has already introduced new and re-designed products and its recently acquired additional plant in Sheboygan, Wis. has been completely automated for mass production.

Robert M. Van Tassel was named head industrial designer for **Joy Manufacturing Company.** Tassel, who will be attached to the Pittsburgh executive staff, has been with the company for seven years.

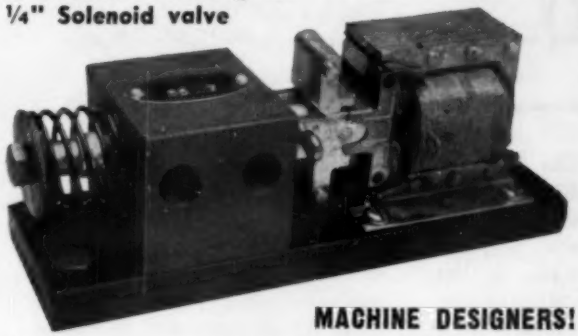
The U. S. Hoffman Machinery Corporation, Industrial Filtration Division has transferred the manufacture and sales of its bypass, fullflow and portable filters, oil conditioners, vaporizers and preheaters to its affiliate, the **Hoffman-Allen Corporation,** Springfield, Mo. Product design and sales policies will remain unchanged under this arrangement.

Sperry Gyroscope Company, Ltd., Brentford, England, has been established as an overseas manufacturing source for Vickers aircraft hydraulic systems. Both

Continued on page 118

Circle 11 on Reader Service Card

BACHMAN Model #743
¼" Solenoid valve



MACHINE DESIGNERS!

Get the full story on Bachman's new long-life laminated plastic valves.

Built for consistent dependability, they will meet today's requirements for automatic machine control and give *you* the same satisfaction so many are now enjoying.

Ruggedly constructed valve body and base are made of light weight phenolic laminates which absorb shock and noise and are amazingly unaffected by wear. Standard O-ring seals are recessed in valve body.

Aluminum spool is micro-finished and hard coated by a sensational new process which maintains bubble-tight performance under most difficult conditions.

Stock models include ¼" pipe size in 2-way, 3-way and 4-way action, for pressures to 200 PSI. You have your choice of single or double solenoid actuation in 110 or 220 volt continuous duty coils, with steel solenoid covers and safety connectors optional.

Consult your nearby distributor or write today for specifications which you can apply to your own automatic control problem.

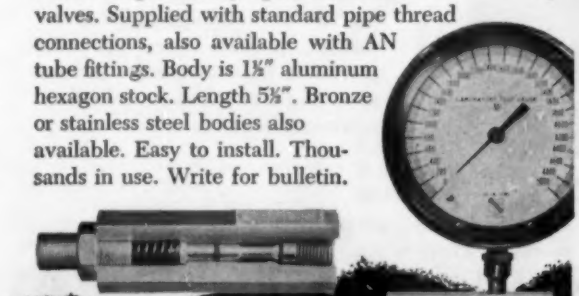
Made and guaranteed by

JOHN D. BACHMAN & CO.

1713 Sparger Lane — Bristol, Tennessee

PROTECT
EXPENSIVE GAGES

SPRAGUE SHUT OFF VALVES automatically cut out gages and other pressure-sensitive instruments when fluid pressures go beyond their operating limits. Automatically open when pressure is again within approx. 80% of set cut-out points. Available for any pressure setting between 10 PSI. and 5000 PSI. Save valuable man hours. Eliminate opening and closing manually operated shut off valves. Supplied with standard pipe thread connections, also available with AN tube fittings. Body is 1½" aluminum hexagon stock. Length 5⅛". Bronze or stainless steel bodies also available. Easy to install. Thousands in use. Write for bulletin.



SPRAGUE
Engineering Corporation
1144 WEST 135TH STREET, GARDENA, CALIFORNIA

NOTICE

to the users of

Master Catalog

of

Fluid Power Products

The following is a complete list of our distributors some of which the publishers inadvertently left out of our listing in the 1956-57 edition of the MASTER CATALOG OF FLUID POWER PRODUCTS

ALABAMA: Birmingham, Moore-Handley Hardware Co., Inc.,; Mobile, Moore-Handley Hardware Co., Inc.; **ARIZONA:** Phoenix, Arizona Hardware Co., Ducommun Metals & Supply Corp.; Tucson, Arizona Hardware Co.; **CALIFORNIA:** Bakersfield, Tay-Holbrook, Inc.; Eureka, Tay-Holbrook, Inc.; Fresno, Tay-Holbrook, Inc.; Los Angeles, Allied Supply Co., Ducommun Metals & Supply Corp., Pacific Metals Co., Ltd., Warren & Bailey Co.; National City, Ducommun Metals & Supply Corp.; Oakland, American Brass & Copper Co., Tay-Holbrook, Inc.; Sacramento, Tay-Holbrook, Inc.; Salinas, Tay-Holbrook, Inc.; San Carlos, Tay-Holbrook, Inc.; San Diego, Warren & Bailey Co.; San Francisco, C. W. Marwedel, Pacific Metals Co., Ltd., Tay-Holbrook, Inc., Warren & Bailey Co.; San Jose, Tay-Holbrook, Inc.; Santa Rosa, Tay-Holbrook, Inc.; Stockton, Tay-Holbrook, Inc.; Vernon, Amstan Supply Division; **CONNECTICUT:** Hartford, L. L. Ensworth & Son, Inc.; Waterbury, Torrington Supply Co.; **FLORIDA:** Jacksonville, Cameron & Barkley Co.; Miami, Cameron & Barkley Co.; Miami Springs, The Fitting Supply Co.; Orlando, Cameron & Barkley Co.; Tampa, Cameron & Barkley Co.; **GEORGIA:** Savannah, Cameron & Barkley Co.; **ILLINOIS:** Chicago, Barrett-Christie Co., Triton Company; Peoria, Wilkins Pipe & Supply Co.; Rockford, Mid States Corp.; Rock Island, Amstan Supply Division; **INDIANA:** Evansville, Budlock Refrigeration Supply Co., Amstan Supply Division; Fort Wayne, Amstan Supply Division; Indianapolis, Central Rubber & Supply Co., Hubbell Metals, Inc.; South Bend, Amstan Supply Division; **KANSAS:** Wichita, Standard Products Co.; **LOUISIANA:** Shreveport, Peerless Supply Co.; **MAINE:** Portland, A. E. Borden Co., Inc.; **MARYLAND:** Baltimore, Carey Machinery & Supply Co.; **MASSACHUSETTS:** Boston, A. E. Borden Co., Inc.; **MICHIGAN:** Detroit, Copper & Brass Sales, Inc., Taylor Supply Co.; Grand Rapids, Copper & Brass Sales, Inc.; **MINNESOTA:** Minneapolis, Air Engineering & Supply Co., Duncan Co., John Henry Foster Co., Amstan Supply Division; **MISSOURI:** Kansas City, Allied Brass, Copper & Plastics, Hubbell Metals, Inc.; St. Louis, Hubbell Metals, Inc.; **NEBRASKA:** Omaha, John Day Rubber & Supply Co.; **NEW JERSEY:** Newark, Jones & Auerbacher, Inc.; **NEW YORK:** Buffalo, Beals, McCarthy & Rogers, Inc., H. D. Taylor Co.; New York, Spohr Co.; Rochester, Ontario Metal Supply Co.; **OHIO:** Akron, Good Supply & Equipment Co.; Cincinnati, Vulcan Copper & Supply Co.; Cleveland, W. M. Pattison Supply Co.; Mansfield, Amstan Supply Division; **OKLAHOMA:** Oklahoma City, Republic Supply Co.; Tulsa, Jones & Laughlin Steel Corp.; **OREGON:** Eugene, American Steel & Supply Co.; Portland, American Steel Warehouse Co., Eagle Metals, Inc. of Oregon; **PENNSYLVANIA:** Bradford, Bovaird & Seyfang Mfg. Co., Inc.; Erie, Cohen Industrial Supply, Inc.; Philadelphia, Casanave Supply Co., Inc., Parker Armstrong Co.; Pittsburgh, Gateway Industrial Supply Inc.; **RHODE ISLAND:** Providence, Franklin Supply Co.; Pawtucket, Lincoln Supply Co.; **SOUTH CAROLINA:** Charleston, Cameron & Barkley Co.; **TENNESSEE:** Chattanooga, Moore-Handley Hardware Co., Inc.; Memphis, Hubbell Metals, Inc.; Nashville, Moore-Handley Hardware Co., Inc.; **TEXAS:** Dallas, Briggs-Weaver Machinery Co.; Houston, Thermal Supply Co., R. J. Gallagher Co.; **UTAH:** Salt Lake City, Metals Supply Co., Pacific Metals Co., Ltd.; **WASHINGTON:** Seattle, Eagle Metals Co.; Spokane, Eagle Metals Co.; **WEST VIRGINIA:** Charleston, A & I Supply Co.; **WISCONSIN:** Appleton, I. Bahcall, Inc.; Milwaukee, Mormon Belting & Supply Co.; **CANADA:** Alberta, Edmonton, Mechanic's Supply Ltd.; B. C., Vancouver, Fleck Bros., Ltd.; Ontario, Brantford, Williams Supply Co.; Hamilton, Vallance Brown; Ottawa, Keyes Supply, Ltd.; Toronto, A. C. Leslie & Co., Ltd.; Quebec, Montreal, A. C. Leslie & Co., Ltd.

We suggest that you paste this on page 24 of the MASTER CATALOG under our listing.

Imperial Brass Mfg. Co.

1200 W. HARRISON STREET
CHICAGO 7, ILLINOIS

Post Scripts of Industry

continued

Vickers, Inc., and Sperry Gyroscope Co., Ltd., are divisions of the Sperry Rand Corporation. This new source wil enable European nations to secure accessories from England or the United States.

Election of **R. S. Reynolds, Jr.,** as chairman of the board of **Robertshaw-Fulton Controls Company** has been announced. Reynolds has been associated with the company since its formation, serving as a director and financial vice president. **J. Louis Reynolds** and **John A. Robertshaw, Jr.,** were named directors.

R. S. Reynolds, Jr.
Robertshaw-Fulton Controls Co.

The consolidation of product lines, sales organizations and activities of **The United States Gasket Company** and **The Belmont Packing and Rubber Company** has been announced. This new combination, to be known as **U. S. Gasket—Belmont Packing,** has **Harry Scott** as general sales manager. He previously headed sales for U. S. Gasket.

Two new positions have been created during a major reorganization of the equipment operations of **Raytheon Manufacturing Company. John H. Beedle** has been appointed manager of commercial equipment and **Gordon S. Humphrey** manager of government equipment. The changes were made to facilitate further expansion of the company's commercial and military projects. Four departments make up the commercial equipment organization: Commerical engineering, a new unit, headed by **N. B. Nichols,** an authority on servomechanisms and automatic controls; commercial manufacturing headed by **J. Glasser;** transformer plant directed by **K. W. Gordon** and commercial marketing under **D. J. Webster.**

Lear, Inc., has appointed **J. E. Sullivan** as manager of the company's Washington, D. C. offices. He recently resigned as civilian chief of the Bureau of Aeronautics Airborne Equipment Division.

National and international sales of the **Trabon Engineering Company's** products wil be supervised by **E. W. Baumgardner,** who was appointed sales manager. Prior to joining the firm, Baumgardner was associated for nine years with Industrial Ovens, Inc.

E. W. Baumgardner
Trabon Engineering Corp.

Theron S. Bushnell has been named Midwest district manager of **Tube Turns Plastics, Inc.** Working out of Chicago headquarters, his territory will include Illinois, Indiana, Iowa, Minnesota, Wisconsin, Michigan, Ohio, West Virginia and Missouri, as well as customers in the Pittsburgh area.

Worthington Corporation has elected **George F. Habach** to vice president in charge of engineering with full administrative responsibility for engineering activity, including research and development. **Harry A. Feldbush,** formerly vice president in charge of engineering, after 40 years service with the company will continue on the technical staff as consultant on special engineering problems.

George F. Habach
Worthington Corporation

Seventy salesmen and representatives from the United States, Canada and South America, attended the second general sales conference recently held by **Chiksan Company,** a wholly owned subsidiary of Food Machinery and Chemical Corporation. Visitors were taken on a guided tour of the plant to familiarize them with production methods and office procedures. At this three day meeting new products were introduced, current projects presented and personnel from both sales and engineering departments joined in product discussions.

Parker Appliance Company has announced the appointment of two new O-ring distributors. **D. Schultz Co.,** Minneapolis, Minn., and **Milam Aircraft and Industrial Supply Co.,** Dallas, Texas. Both firms will carry extensive stocks for prompt servicing.

Arnold E. Amadon has rejoined the **Graton & Knight Company** as supervisor of packings and textile sales. Amadon started with the firm in 1930 and left in 1947 to establish his own business. Amadon succeeds Leslie C. Street.

Arnold E. Amadon
Graton & Knight Co.

Rhodes Lewis Corp., has been purchased by **Fairchild Engine and Airplane Corp.,** Hagerstown, Maryland. Rhodes Lewis was formerly owned by McCulloch Motors Corp.

Snap-Tite, Inc., has appointed **Stewart Miller Associates, Inc.** Needham, Mass., as their new representative. The company, headed by **Stewart Miller,** will cover the states of Maine, New Hampshire, Vermont, Massachusetts and Rhode Island.

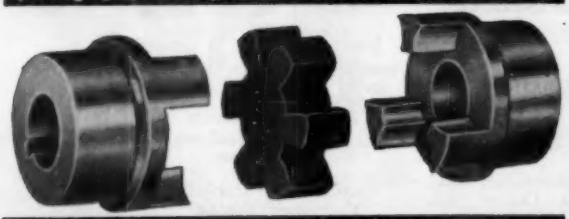
Central States Industrial Supply Company, Cleveland, has become a distributor for high pressure hose assemblies made by **Stratoflex, Inc.**

To manufacture and market its electrical distribution and control products, **Square D Company,** Detroit, has formed an English subsidiary, known as **Square D Ltd.** Manufacture of selected motors has been subcontracted to **Plessey Co., Ltd.** Sales branch offices are to be established in important industrial centers such as Birmingham, Manchester and Glasgow. Directors of Square D Ltd., are **F. W. Magin, F. H. Roby** and **J. F. Magin** of the parent company and **B. C. Spicer** and **R. P. Chambers** of the United Kingdom.

Benedict Engineering & Sales Company, Birmingham, Alabama, has been appointed by **Rivett Lathe & Grinder, Inc.** as representatives for their line of air and hydraulic products. **S. R. Benedict, Jr.,** who organized the firm in May 1955, has 20 years experience in selling, engineering and supervising installation of equipment. The company will cover Alabama, Mississippi and North West Florida.

S. R. Benedict, Jr.
Benedict Engineering & Sales Co.

A GERBING EXCLUSIVE!



FLEXIBLE COUPLING with
Concave Jaw Surfaces...

The exclusive CONCAVE jaw surfaces of the Gerbing Flexible coupling actually holds the Buna-N rubber insert or spider within the jaws and prevents the rubber from extruding under load. Effectively absorbs shock, vibration, and misalignment. Requires no lubrication. Available for shafts ½" to 2⅛" and H.P. ranges from fractional thru 30. Deliveries from dealer and factory stocks. Increase your coupling service life. Write for complete information.

Concave jaws hold spider in position at all times . . . no extruding

Hub, bore, and outside diameter concentricity assure vibration-free operation.

GERBING
MANUFACTURING CORP.
Northbrook, Ill. (Suburb of Chicago)

Dept AP-1255

Circle 40 on Reader Service Card

Gresen
HYDRAULIC
CONTROL VALVE
(Directional)

Model S.P.

- For Single or Double Acting Cylinders
- Pressures to 1500 PSI
- Built-in Adjustable Relief
- Ball Checks
- Openings—½" cylinder ports, ¾" inlet and outlet.

Write for literature

GRESEN MANUFACTURING CO.
628 Colfax Ave. N. Dept. A-55 Minneapolis 11, Minn.

Circle 43 on Reader Service Card

1955 APPLIED HYDRAULICS Editorial Index

ACCUMULATOR CIRCUITS

Design Considerations for "Stopping That Bounce"
By James J. Melead Mar. p 66

Hydraulic Device Closes Circuit Breaker
By E. R. Perry May p 71

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Abtracts of Technical Papers to be given at the 11th NCIH Oct. p 68

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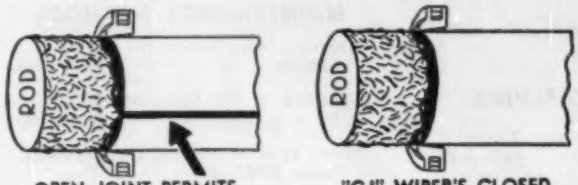

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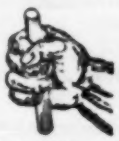

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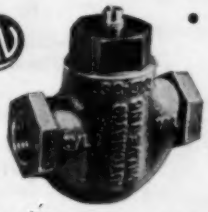

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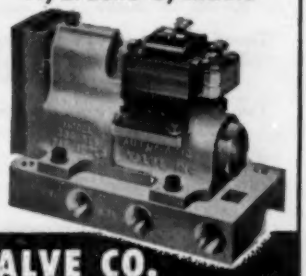

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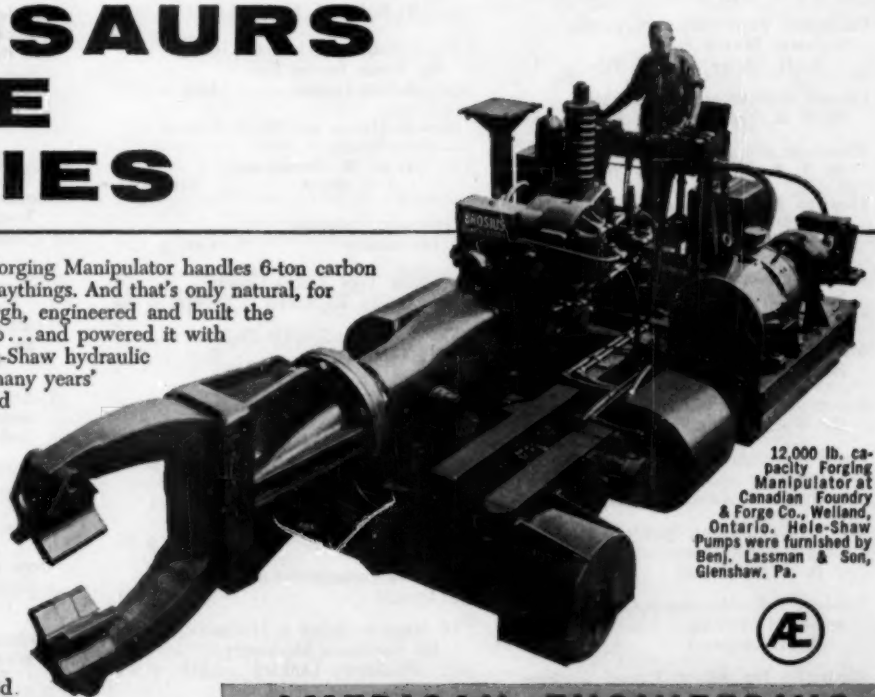

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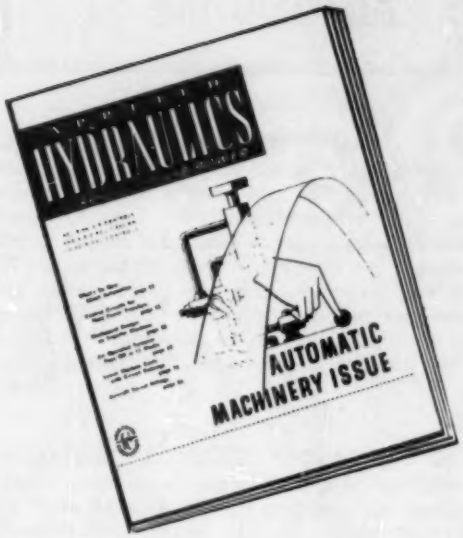

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of Technical Manuals, Bulletins and Catalogs

. . . which have been listed
in APPLIED HYDRAULICS Magazine
during the last six months

Any item (s) will be sent to you promptly if request is made on the postage-free Reader Service Card.

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Published March 1955

Accumulators and Boosters

AIR DRIVEN HYDRAULIC PUMP . . . designed for small volume capacity at low and high pressures is the subject of a new data sheet offered by The Aldrich Pump Company. Available in either single or double acting models, the pump develops up to 30,000 psi at 90 psi air supply, provides for such applications as testing tubing, valves and pressure vessels, and supplying power for small molding presses. The data sheet gives complete information on design, installation, operation and is illustrated by photographs, sectional and dimensional drawings.

Circle No. 1

BOOSTERS, ACCUMULATORS . . . and air-hydraulic units are subject of an 8 page brochure released by Petch Manufacturing Company. The brochure also discusses air to oil and oil to oil cylinder type accumulators. Similar in application to bladder type accumulators but with the added advantage of a working pressure boost over the maintained back-up pressure. The well illustrated catalog features construction diagrams, circuits and a booster selector chart.

Circle No. 2

HYDRO-PNEUMATIC ACCUMULATOR . . . that will cushion shock and vibration is described in Bulletin 1100, available from Greer Hydraulics, Inc. The complete assembly consists of a steel alloy shell, a synthetic compound separator bag incorporating an integrally molded air valve, and an oil port assembly. This component is especially recommended for mobile applications, and the brochure shows a typical accumulator installation on a fork truck and its operation.

Circle No. 3

HIGH PRESSURE COMPONENTS . . . are featured in Martin-Decker Corp.'s 4-page bulletin, M-15. It illustrates a hydraulic pressure booster which, when connected to water and air supplies, can build up pressures as high as 25,000 psi. Simple to install, easy to operate, the unit has no motors, pumps or gears. Also shown are check valves, made of cold rolled steel, brass or stainless steel, available in working pressures up to 25,000 psi; and self-sealing couplings, designed to fit either male or female ¼ N.P.T. threads.

Circle No. 4

AIR DRIVEN LIQUID PUMP . . . capable of developing pressures to 30,000 psi is described in a 4 page bulletin covering data on the Model S-216-C. The bulletin is available from Sprague Engineering Corporation. The pump may be incorporated directly into the design of all types of hydraulic machines. It may be used to replace electrically driven hydraulic pumps where the flow requirement is low. Operating characteristics, specifications and capacity data is included. Cutaway view shows the construction.

Circle No. 5

Air Compressors

"ORIGINAL EQUIPMENT APPLICATION IDEAS FOR PRODUCT DESIGNERS" . . . is the title of a new brochure by Gast Manufacturing Corp. Bulletin 1054-5 shows how 35 product component problems were solved with rotary air motors, air compressors and vacuum pumps manufactured by the company. Photographs of applications, together with detailed captions describing hp requirements, air pressure used, rpm of the unit and other data, are shown. Briefly described are also recent additions to the Gast line of original equipment components.

Circle No. 6

AIR COMPRESSOR . . . of the Utility 105 cfm type has been placed back into the compressor line manufactured by Le Roi Company, after an absence of several years. A bulletin describes the new and improved features. Installation drawings show the width is 25 inches and the length only 82 inches. Photos show the compressor with and without removable lightweight expanded metal hood sides. Specifications for the compressor and engine, as well as a complete rundown on tool capacities are included.

Circle No. 7

LOCATING AIR COMPRESSOR TROUBLES . . . in vertical, water cooler air compressors is subject of new bulletin L-676-M1, being offered by Worthington Corp. This is one of a series on preventive maintenance being issued by the company to assist in reducing costs of operation. It is designed to help operators of YC and DYC compressors detect existing troubles and be alert to ways these can be prevented. Graphically illustrated, it clearly explains reasons for such troubles as failure to deliver air, insufficient capacity, insufficient pressure, vibration, overheating, overloading motor, low or high intercooler pressure.

Circle No. 8

PORTABLE AIR COMPRESSORS . . . developing high pressure, are described in product sheet No. 5, issued by The Cornelius Company. The 32 series has a pumping capacity of .6 cfm of free air. Will compress 25 cu ft of free air to 2500 psi in 45 minutes. The 130 series, has a pumping capacity of 2 cfm of free air. Will compress 25 cu ft of free air to 3000 psi in 15 minutes. Both series are air cooled, 3 stage design. Both have integral oil reservoirs and efficient interstage cooling.

Circle No. 9

AIR COMPRESSORS . . . for industrial service are described in a 12 page catalog offered by Quincy Compressor Co. Dimensional and construction data is given for single stage single cylinder; two stage compressors; and both base and tank mounted compressors. Compressors feature honed cylinder walls, copper finned intercooler, cushioned steel valves and semi-steel pistons.

Circle No. 10

HEAVY DUTY AIR COMPRESSORS . . . Joy Manufacturing Company has released a new 36 page bulletin A-72 on compressors for industry. The bulletin contains complete information on construction and operation of the compressor. Illustrated are seven models. Features of the units described include replaceable crosshead, cylinder liners and full force-feed lubrication.

Circle No. 11

Cylinders and Fluid Motors

AIR MOTORS AND VALVES . . . manufactured by The Bellows Company are featured in a 28-page bulletin, SP-50. This "Spec-Book" illustrates and describes completely dimensions and specifications of their air motors and valves. 75 illustrations and 27 specification charts help facilitate the application of these units. Charts give size and capacity designations. Accessory items are also included in the bulletin.

Circle No. 12

AIR CYLINDERS . . . which feature built-in valves in the rear head are detailed in The A. K. Allen Co.'s new 4 page bulletin. Shown are Models SVA and SVE, available in 2 inch and 3 inch bores and any length of stroke up to 60 inches. The built-in valves are of the slider type, slider is actuated by a spool whose instantaneous motion is achieved through two bleeder valves. A choice of mounts is available for mounting cylinders in any position.

Circle No. 13

PLUG VALVE ACTUATOR . . . for the remote control of all types and sizes of wrench-operated plug valves from 1 inch to 8 inches is described in an eight-page illustrated bulletin published by The Pantex Manufacturing Corporation. The company manufactures the complete unit, cylinder and actuator. It comes completely assembled ready to attach to pipe and plug valve stem. These actuators are designed for pneumatic operation, but provision can be made for hydraulic operation on special order. The unit will operate in any position at operating pressures from 30 to 125 psi. The bulletin is illustrated with photographs of typical installations, detailed line drawings and gives complete engineering data.

Circle No. 14

HYDRAULIC CYLINDERS . . . for pressures up to 3000 psi are presented in catalog No. 741 released by Hydraulic Power Division, The Hydraulic Press Mfg. Company. The catalog is very complete and covers all material thoroughly. Many different mountings are illustrated and dimensioned for installation purposes. Features and cut-a-way view of the cylinder are included. Other subjects discussed are single acting cylinders, telescoping cylinders, large bore cylinders, special cylinders, accessories and capacities.

Circle No. 15

PLUG VALVE ACTUATORS . . . pneumatically and hydraulically operated for remote controls and automatic processing, are the subject of an 8 page bulletin 3020, released by Ledeen Mfg. Co. Designed for installations either on new valves or on existing valves already in service. Air, oil or water actuators are available. Direct or remote control by hand or pilot operated valves. Suitable for most control requirements including instrument controls. Applications, mountings and dimensions are also included.

Circle No. 16

HYDRAULIC CRANKING MOTOR . . . known as the Hydrotor, provides a higher and hitherto unobtainable stored starting capacity in a unit of comparable size. The unit operates in a closed hydraulic system completely independent from batteries and does not require regular maintenance checks. The essential features of the Hydrotor which is made in three sizes are illustrated and described in a folder published by Hydramotive, Inc.

Circle No. 17

POWER JACKS . . . The majority of machining, grinding, welding, riveting, drilling and many other operations on irregular shaped pieces, necessitates some sort of a fixture to support the piece in the desired position. A bulletin, released by Power Jacks, Ltd. describes a clamping device which provides a simple means of holding work. The system comprises a hand operating hydraulic pump, and one or more hydraulically operated plungers.

Circle No. 18

CYLINDERS . . . for air and hydraulic operation featuring unusually large capacity to size ratio are explained in catalog No. 750 offered by Hanna Engineering Works. The catalog consists of 16 pages and is filled with information about cylinders. A cross section view shows the construction and features. Various mountings are illustrated and dimensional data given for the mountings will assist in preparing machine layout drawings. Both push and pull forces are given in a capacity chart for each cylinder size at various pressures between 30 psi and 750 psi.

Circle No. 19

AIR AND HYDRAULIC CYLINDERS . . . in popular sizes and mountings are now carried in stock by Miller Fluid Power Co. A 12 page booklet, "A Cylinder Program for Automation and Heavy Duty Dependable Service" describes this service, and gives mounting dimensions of their 200 psi air cylinders and their 2000 psi hydraulic cylinders. Along with this information are dimensions of other sources which wholly or partially conform to the Miller line. A large cross sectional view of both cylinder types, shows the construction of the cylinder and various features of the component parts.

Circle No. 20

HONING OF CYLINDERS . . . to customer's specifications is American Hollow Boring Co.'s specialty. A four page bulletin describes and illustrates its facilities and examples of their products. Equipped to manufacture cylinders from 1¼ inch to 15 inch I.D. and 27 feet in length, they can be furnished in seamless tubing, with welded flanges and bases and from solid bar stock. Exacting tolerances and honed finish are rigidly maintained.

Circle No. 21

HYDRAULIC CYLINDERS . . . for low pressures are presented in a 4 page folder released by Rotex Punch Co., Inc. Available in bore sizes of 1⅛, 2, 3 and 4 in bores, they are supplied in non-cushioned and cushioned models. The cushioned model is not available in 1⅛ in size. Complete mounting data is given for the standard size cylinders. Six mountings are illustrated, base, foot, flange, pivot, clevis and nose. Installation data is given for each of them. A chart shows the load capacity of cylinders, for various pressures.

Circle No. 22

SLIDERULE CALCULATOR . . . for selecting air hydraulic cylinders is available from Air and Hydraulic Division, Lindberg Engineering Company. A time saving tool it provides quick information on cylinder diameters, areas, pressures, forces and displacements.

Circle No. 23

Electrical Components

TIMERS . . . a vital part in modern industries new trend to automatic manufacturing is the subject of a new 12 page booklet, Form 354 released by Eagle Signal Corporation. Many of the company's products used in solving the problem of relating and coordinating machines and processes automatically, are completely described. Several reset timers and repeating cycle timers are illustrated and the features and operation of each are given.

Circle No. 24

PRESSURE SWITCH . . . for on-off control of aircraft and mobile pressurizing pumps is described in a catalog sheet available from United Electric Controls Company. The unit provides a positive switching action in response to source pressure variations independent of atmospheric pressures and temperatures. All features, applications, operation, electrical connections, outline dimensions, and adjustment are completely detailed. Ordering information is included.

Circle No. 25

SOLENOIDS . . . of a newly designed line, manufactured by Joseph Pollak Corporation are described in a new catalog. Light-weight and compact in design, the solenoids are available in a wide variety of mountings, coils and wire sizes. Three hundred different types of custom solenoids may be assembled from twenty standard parts. An unusual features of this line, series 100 and 300, is simplified change-over to push or pull type by adding a threaded 3/32 inch diameter push rod to any plunger. The catalog includes performance curves and typical coil data.

Circle No. 26

ELECTRIC TIMING DEVICES . . . are described in catalogs and engineering bulletins made available by Haydon Manufacturing Co., Inc., Catalog No. 322 describes several series of timing motors which are suitable for any application. Catalog No. 323 outlines the timing devices available, including time delay relays, reset timers, interval timers, elapsed time indicators, fixed interval repeat cycle timer and direct current timers. Catalog No. 324 covers the clock movements available.

Circle No. 27

ENCLOSED WIRING BOXES . . . manufactured to J.I.C. standards are described in literature available from Hoffman Engineering Corporation. Protection to electrical equipment and wiring is assured as the boxes are oil and dust tight. There are no knockouts or holes. Relays and timers can be mounted in the box, as the box is equipped with a removable panel for this purpose. All dimensions are included for the various models which are available, showing box and panel size, mounting holes and overall dimensions.

Circle No. 28

"SWITCHES FOR INDUSTRY" . . . is the title of a newly published catalog, available from Micro Switch, a division of Minneapolis-Honeywell Regulator Co. Catalog 101 consists of 20 pages, in color and covers 22 different types of switches, describing 258 different switches, actuators and enclosures. Photos are used to show outside dimensions. Characteristics, electrical ratings and technical data are so arranged as to aid the designer in the selection of the correct switch for his application. The products described range from postage stamp size "V-3" to heavy duty "ML" limit switches.

Circle No. 29

ELECTRIC RELAYS . . . Six relays are presented in a 4 page folder made available from Sigma Instruments, Inc. Duplicate information is given for each of the types; this includes rating, sensitivity, maximum coil resistance, coil dissipation, speed range; mountings, enclosures and designations; and features. The relay series covered in the bulletin include, dc relays; ac and dc relays; dc relays midget; dc relays-polar and dc relays-polar, telegraph keying.

Circle No. 30

LIMIT SWITCHES . . . designed to meet severe mechanical and electrical conditions imposed by heavy duty machines are the subject of a folder prepared by Electrical Mfg. Division, The National Acme Company. Literature shows the various types of limit switches available, design features, specifications, wiring diagrams and ordering data. Also included are other electrical components and controls.

Circle No. 31

TIMING RELAYS . . . are covered in a 16-page bulletin offered by Allen-Bradley Company. Described and illustrated are four different types of relays, fluid dashpot timing relays, pneumatic timing relays, process timers and electronic timing relays. Features, operation, engineering data and applications are given for each unit. Factors to be considered when selecting timing relays are also outlined.

Circle No. 32

Electric Motors

ELECTRIC MOTORS . . . which conform to the new NEMA Standards for mounting dimensions and frame assignments for integral horsepower motors are shown in bulletin No. 1600 published by The Louis Allis Co. Comparison of principal dimension between old and new frames are charted for the 1—40 hp induction motors.

Circle No. 33

ELECTRIC MOTORS . . . of the new Series 100 are the subject of Howell Electric Motor Company's new bulletin. This line of motors, re-rated according to new NEMA designs, introduces smaller frame diameters for a-c motors, 1 to 30 hp, saving considerable weight and space. The bulletin states that because of new improved insulation, better motor design and ventilation, heat is dissipated more effectively. The brochure includes dimensions and data of new frame sizes.

Circle No. 34

ELECTRIC POWER DRIVES . . . are presented in a new 8 page application tabloid bulletin, released by Sterling Electric Motors, Inc. Brochure presents 60 photographs on power drives for machinery and many other kinds of equipment. Pages have been divided by industries, and include application stories from food, metal, chemical, petroleum, plastic, paper, printing, lumber and textile industries.

Circle No. 35

ELECTRIC MOTORS . . . Performance tests of different brands of electric motors and their results are published in a 4 page brochure. Offered by The Electro Dynamic Motor Generator Division of the General Dynamics Corporation, the booklet presents the information in tabular form for engineering performance, and comparison, in visual color charts, as to what the results prove in relation to use.

Circle No. 36

ELECTRIC MOTORS . . . manufactured by U.S. Electrical Motors Inc., are featured in a new multicolored booklet. It presents the 20 principal types, including uniclosed, totally-enclosed, explosion proof with and without fan, combination variable speed and internally geared units. Cutaway views of Varidrive and Syncrogear types are shown in full color. Also given are details on Lubriflush transverse bearing lubrication, asbestos-protected windings and normalized motor castings.

Circle No. 37

Filters

HYDRAULIC OIL FILTER . . . with a built-in bypass is described in literature available from Bendix-Skinner Division of Bendix Aviation Corp. Of sturdy aluminum die cast construction, the filter is available with either cleanable ribbon type elements for 40-micron filtration or replaceable pleated type for 10-micron filtration.

Circle No. 38

SYNCLINAL FILTERS . . . manufactured by Marvel Engineering Co. are featured in catalog No. 106. Illustrated are sump type and line type filters, their parts listed and complete engineering data included. Theoretical flow and pressure drop table and standard viscosity temperature charts are also given.

Circle No. 39

INDUSTRIAL FILTERS . . . A new 8 page catalog No. AK050 has been published by The Cuno Engineering Corp. which describes the full line of filters. Positive filtration is obtained by passing a fluid, containing solids, between discs, placed edgewise to the flow. These discs are on a center support rod, separated from each other by a spacer. The thickness of this spacer determines the degree of filtration. Specifications and capacities are given for all models having flow rates between 1 and 3760 gpm and operating pressures of 125 psi.

Circle No. 40

HYDRAULIC FILTERS . . . with radial fin insert are the subject of Bulletin HF-2 published by Dollinger Corporation. The unit is of simple design, only three major parts, lower end plate, insert and combined supporting tube and upper end plate with threaded outlet sleeve. Complete specifications and application data are given.

Circle No. 41

OIL FILTERS AND PURIFIERS . . . illustrated in a new bulletin, demonstrates how these units are presently used and suggests additional and similar applications in pipe line and industrial fuel and lubricating oils. Prepared by Purifier Division, Hilliard Corporation, the bulletin describes newer installations for lubricating and non-lubricating oils in transformers, circuit breakers, heat treating, wire drawing and hydraulics.

Circle No. 42

HIGH PRESSURE FILTERS . . . The Trabon Engineering Corp. has published a 2 page bulletin No. 545, on their high pressure lubrication filters. They are constructed of high tensile cast aluminum with steel sump and tie rod and are built to withstand 1000 psi working pressure and 1800 psi test pressure. The bulletin includes dimensional material, illustrations, diagrams and comprehensive flow loss charts.

Circle No. 43

Heat Exchangers

HEAT EXCHANGERS . . . of the "F" shell and tube type, made by Young Radiator Company, are described in their new catalog No. 1245. This 12 page, two color, brochure contains application photographs covering a wide range of industries, presents materials, construction features, dimension drawings and tables. Four pages of the catalog are devoted to a simple, complete guide to heat exchanger selection. This data includes all necessary tables and formulas for selecting exchangers involving the most common cases of water-to-water and water-to-oil heat transfer.

Circle No. 44

PLATE TYPE OIL COOLER . . . is featured in a 4 page bulletin prepared by Harrison Radiator Division, General Motors Corp. Design and construction of this unit is outlined, photographs show parts and assembly.

Circle No. 45

AFTERCOOLERS . . . A 4 page folder, describing a water cooled aftercooler for removing oil and moisture from compressed air systems from 100 to 500 cfm, is available from The Heat-X-Changer Co., Inc. Use of longitudinal inner-fins permits maximum heat transfer with minimum pressure drop. The booklet is well illustrated, showing construction and dimensions.

Circle No. 46

HEAT EXCHANGER . . . Bulletin No. 120 prepared by Niagara Blower Co., describes the operation of the heat exchanger used in cooling or controlling of temperatures of industrial liquids. It shows the operation of this equipment by means of diagrams and examples of application by installation photos. Included is a large cut-a-way view showing the construction.

Circle No. 47

Hydraulic Oils

INDUSTRIAL OIL HYDRAULICS BOOKLET . . . is a handsome 22 page multi colored text published by Cities Service Petroleum, Inc. The first chapter gives a brief introduction to the meaning of hydraulics and its ever growing application in industry. The principles of hydraulics described and illustrated with drawings show how force is developed and the building of the system. Pumps, valves, accumulators and cylinders, fluid couplings, torque converters and typical hydraulic circuits are explained. The chapter on hydraulic oil stresses the seven important factors to consider in hydraulic oil selection, also covers filtering and cleaning procedures. A list of oils and recommended applications completes this booklet which should be a handy reference edition for those who design, operate and maintain industrial oil hydraulic equipment.

Circle No. 48

FLAME RESISTANT FLUID . . . An eight page booklet on Lindol HF hydraulic fluid has been released by the Chemical Division of Celanese Corporation of America. The hydraulic attributes of the fluid are stated, physical properties and specifications given. Uses, application and installation information are included.

Circle No. 49

EXTREME PRESSURE LUBRICANT . . . is a lithium base product containing Molykote molybdenum disulphide powder. Bulletin 101, prepared by The Alpha Corp. carries the specifications covering the lubricant and prices. The lubricant is suitable for use in highly-loaded ball and roller bearings and on heavily-loaded sliding friction surfaces. It is oxidation inhibited and has an operating temperature range from –30 F. to 350 F. The bulletin is in two colors and contains interesting information concerning the product.

Circle No. 50

HYDRAULIC FLUID . . . for industrial and aircraft use is described in a 12 page brochure published by Carbide and Carbon Chemicals Division, Union Carbide and Carbon Corp. Known as Ucon Hydrolubes, the literature lists how to use this fire resistant fluid and its advantages.

Circle No. 51

AIRCRAFT HYDRAULIC FLUID . . . its advantages, properties and conversion costs, are discussed in a new 16 page revised booklet. This publication, prepared by Monsanto Chemical Company's Organic Chemicals Division, states that present systems can be converted readily to fire-resistant Skydrol by a minimum of aircraft processing and material changes. The booklet also includes a sample itemized tabulation of man-hours required for conversion at either the 8,000-hour overhaul or pattern overhaul period.

Circle No. 52

NON-FLAMMABLE SAFETY PACKAGE . . . which consists of a group of processing products that are safe to use in the vicinity of fire and intensive heat, is described in an 8 page folder available from E. F. Houghton & Co. One of the products presented is their non-flammable hydraulic fluid. It will not burn or explode. They produce a rust preventative, safe water solution which cleans at room temperature and an all purpose water-soluble cutting base.

Circle No. 53

HYDRAULIC OILS . . . their selection and use is discussed in a new three color catalog designed to aid consumers in making the proper choice of oils. Issued by The Denison Engineering Co., Bulletin No. 45 contains 15 pages and presents all the facts about hydraulic oils and the importance of carefully selecting the one suitable for each operation. Some of the sections of the bulletin reveal "Factors Affecting Hydraulic Oil Performance" and "Procedure to Assure Suitable Oil Condition." The catalog is well illustrated with photographs and charts.

Circle No. 54

Instruments

MEASURING AND CONTROL INSTRUMENTS . . . A new general 12 page catalog illustrates a complete line of process instrumentation available from Fischer & Porter Company. It gives basic specifications and descriptions of pressure and temperature instruments; density and specific gravity measuring instruments; liquid level instruments; electric, pneumatic, and electronic transmitting, recording and controlling instruments with alarms and integrators. Also featured are air-operated control valves in various models and construction materials. One section of the catalog is devoted to centralized control panels, data reduction and automation systems, and other instrumentation packages.

Circle No. 55

LEVEL INDICATOR . . . for application with most non-adhesive chemicals, oils, is the subject of a leaflet offered by Thermo Instrument Co. This meter-indicating level monitor derives its signal from an inert capacitive-type sensing probe. Specifications show that the instrument can be operated from high vacuum to pressures as high as 100,000 psi. Data included illustrates uses of the unit in remote indicating applications where the repeat meter can be located at a practically unlimited distance from the main sensing installation.

Circle No. 56

HAND TACHOMETERS . . . Metron Instrument Company's new bulletin covers the new 3 in 1 hand tachometer which dependably measures the speeds of rotating parts and moving surfaces. The 3 in 1 has three separate ranges in one instrument. Only one range appears at a time, therefore minimizing reading errors. Ranges are selected by merely flipping a handy switch. There is no fear of damage due to overspeeding or selection of the wrong range.

Circle No. 57

TEMPERATURE TEST CHAMBER . . . is designed for the convenience of research workers and the small laboratory unit. Freedom from delays attendant upon scheduling time in larger chambers permits extensive performance of ambient temperature variation tests, reserving the larger equipment for more elaborate environmental testing. Portable and self-contained, it is suited to production line tests of small products. A folder, offered by Statham Development Corp. explains operating instructions and procedure in addition to specifications.

Circle No. 58

FLOWMETER . . . A bulletin, one of a series prepared for the benefit of flow meter users in the automotive, aircraft, chemical and petroleum industries, is No. 1053 prepared by Commercial Research Laboratories, Inc. The bulletin includes major design and construction features of the type 12-100 series unit, maximum flow ranges, and various combinations of metering tubes and by-pass valves which can be used in series. Complete mounting drawings are available. The use of logarithmic rather than the usual linear type scale markings greatly increase the accuracy and readability.

Circle No. 59

PRESSURE GAUGES . . . for various applications are described in Catalog M-5 available from Acragage Corp. It shows construction details of gauges available with a choice of Bourdon spring material dependent on the type of corrosion resistance required and the pressure range of the gauge. Also featured are solid front case gauges, phenol case gauges, electric transmitter gauges. Standard gauge dial graduations, net weights and mounting dimensions are listed.

Circle No. 60

GAGE GUARD . . . to protect sensitive pressure instruments is featured in literature offered by Industrial Engineering Corp. Installed simply in the line between the pressure instrument and the source of pressure, the unit is designed to cut off and prevent further pressure increase at the gage or manometer whenever the source of pressure exceeds the pre-selected cut-off point, and to withstand and hold closed up to 10,000 psig regardless of cut-off setting. The two available models are illustrated and complete engineering data listed.

Circle No. 61

OIL TEMPERATURE REGULATORS . . . are covered in a 12 page catalog, showing the whys and hows of temperature ranges and installation musts. Published by Lawler Automatic Controls, Inc., the catalog explains where and when to use direct acting, reverse acting, three way type thermostatic temperature regulators and lists typical engineering specifications. Illustrated with cut-away photos, diagrams, installation diagrams and engineering tables, the bulletin also details special product features.

Circle No. 62

CONTROL INSTRUMENTS . . . United States Gauge, Division of American Machine and Metals, Inc., published a 4-page Bulletin, GL-1, featuring the Gotham line of indicating, recording and controlling instruments. The bulletin also covers portable running time-temperature recorders, pneumatic off-on indicating controllers and pneumatic proportional recorders for 1 to 100 per cent proportional band.

Circle No. 63

DIAL THERMOMETERS . . . for many different uses, are presented in an 8 page bulletin, Form DT-1-54, published by Rochester Manufacturing Company, Inc. Industrial, laboratory, heavy duty industrial, heavy duty for petroleum and chemical service, and straight form thermometers are all discussed. The features of each type, a complete description of the dial assembly, immersion depth, accuracy and range are included.

Circle No. 64

PNEUMATIC TIMERS . . . Timing relays for either ac or dc power systems are discussed in bulletin No. 225, available from Square D Company. Many timers, for a variety of applications, are illustrated. A cut-a-way view illustrates the operation. A selection table is also included. Planned to aid in the selection of a unit when certain operating conditions are desired.

Circle No. 65

LINEAR ACCELEROMETERS . . . suitable for static and dynamic measurements are described in bulletin AL-1 available from Statham Laboratories, Inc. The resistive nature of the balanced four arm bridge permits operation in either dc or ac circuits, so that a wide range of recording, telemetering and controlling systems may be employed. General specifications and the characteristics of the various models are included.

Circle No. 66

Mechanical Devices

AIR-GRIP CLUTCH . . . for press operation is outlined in a 4-page folder available from Dodge Manufacturing Corp. Embodying several new features, this clutch operates at air pressures up to 150 psi. A cross section drawing shows internal construction. Information is given on air control, release valves, clutch sizes, bore sizes and weights.

Circle No. 67

FLEXIBLE COUPLINGS . . . which will connect electric motors to drive pumps, are described in an eight page catalog No. 55. It illustrates gear type couplings of standard and special types, Francke couplings, cut-out pulleys and junior gear coupling. The catalog, prepared by John Waldron Corporation, gives complete specifications such as working torque range, bore limits, dimensions and shipping weights.

Circle No. 68

CHAIN DRIVES . . . for 50 to 5,000 hp drive applications are outlined in a six page catalog folder available from Morse Chain Company. The folder, which is water and oil-proof plastic material, has complete line drawings and descriptive material dealing with such subjects as sprocket installation, chain assembly, chain cases, lubrication, chain disassembly and maintenance procedures. The folder describes in detail disassembly procedures for both washer-type and spring-lock type connecting links.

Circle No. 69

TRANSMISSION BELT . . . known as Poly-V drive is discussed in a new brochure, #6638, available from Raybestos Manhatten's Rubber Division. Design characteristics of the single, endless belt with molded lengthwise ribs, are explained in two-color line drawings which show why fourteen specific advantages are claimed for the drive. The brochure uses V-belts and sheaves as a standard for comparison of Poly-V with conventional drive. Text and illustrations show in detail why the drive gives twice the contact area, 50 percent more horsepower, eliminates matching and reduces inventory of belts and sheaves.

Circle No. 70

CYLINDRICAL ROLLER BEARINGS . . . are the subject of a new catalog, TR-854-C, issued by Rollway Bearing Company. It lists types, sizes, dimensions and load ratings. Detailed are crowned rollers, a feature which relieves high stress areas at the roller ends. A formula for load ratings and a method for calculating expected bearing life are included in this literature.

Circle No. 71

FLEXIBLE COUPLINGS . . . of the rubber-bronze bushing type are the subject of a selection guide prepared by Ajax Flexible Coupling Co., Inc. This selection guide, Bulletin 57, gives complete ratings, drawings, specifications, service factors and various uses of the types illustrated. This pocket size brochure also shows that the flexible rubber bushings provide necessary freedom of movement between each flange, and a cushioned drive in both directions of rotation.

Circle No. 72

OVER-RUNNING CLUTCH AND COUPLING . . . their construction and operating characteristics are outlined in Bulletin No. 231, offered by The Hilliard Corporation. Various types of clutches are featured together with sectional drawings and complete technical specifications.

Circle No. 73

"FOR GREATER EFFICIENCY" . . . is the title of booklet featuring shock and vibration isolators. The bulletin, prepared by Barry Corporation, discusses the problems of greater utilization of capital equipment, methods of pin-pointing and overcoming sources of inefficient plant and machinery operation. Based on an extensive survey, literature discusses eight steps in attaining efficiency objectives.

Circle No. 74

Packings

"CUSTOMIZED RUBBER ENGINEERING" . . . is the title of a folder which shows what happens when you bring hydraulic sealing problems to Plastic and Rubber Products Company. Folder features in cartoon style how the company is able to design and custom produce a part with fine finish and close dimensional tolerances. Their engineering, testing, mixing and molding facilities enable the company to tailor make rubber requirements for hydraulic, pneumatic, aircraft, automotive, machine tool and many other applications.

Circle No. 75

GROMMETS . . . made in a wide range of proven rubber, synthetic rubber and silicone rubber compounds are listed in a 16 page file folder released by Goshen Rubber Co., Inc. The line includes the compelte Air Force-Navy Standard AN931 grommet series, 34 basic sizes, each size available with 1/16, ⅛, 3/16, and ¼ inch groove width, and the 34 sizes in the web type with 1/16 inch groove width.

Circle No. 76

O-RINGS . . . for general industrial hydraulic fluids as well as water and air service are illustrated in a new four page folder. Manufactured by Stillman Rubber Co., these O-rings are precision molded of Buna N fuel and oil resistant compounds. They are available in a complete range of standard sizes, and special sizes for industrial use.

Circle No. 77

PACKINGS . . . are the subject of a comprehensive circular showing diagrams and tables dealing with homogeneous, leather and fabric V-packings, homogeneous synthetic rubber U-cups and fabric cup packings. Molds have been developed whereby the V-packings of the 3 types are completely interchangeable with one another without upsetting the overall stack height of the set of packings. Bulletin No. 207 is available from Chicago Belting Co.

Circle No. 78

SEAL-GUARD . . . as a protection for hydraulic packings, wipes off dirt. How the rings remove sand, grit, paint, chips and other foreign material is described in a bulletin offered by Hydraulic Accessories Company. Sketches are included which show the most common applications. A chart shows complete dimensions for each seal-guard.

Circle No. 79

RUBBER AND LEATHER PACKINGS . . . Six new technical bulletins, each featuring essential data on individual types of packings have been issued by E. F. Houghton & Co. Compiled to save time for designers, engineers and maintenance departments, each bulletin contains factual information and standard sizes for only one specific style of packing. The leaflets on leather packings also include data on new rubber impregnated leather.

Circle No. 80

PACKING SELECTOR SLIDERULE . . . which will pick out the right packing for almost any application is offered by New York Belting and Packing Co. The selector, a cardboard disc six inches in diameter shows packing styles, pressure and temperature reading for the four types of packing applications, gaskets, valve stems, centrifugal and reciprocating pumps. The material being handled is printed alongside a window in a second and smaller disc mounted on the larger one. The reverse side of the wheel gives the sizes in which the recommended packing is available.

Circle No. 81

PACKINGS . . . recommended for reciprocating and centrifugal pumps are given in a folder prepared by Johns-Manville. The ten types of packings shown have been developed to meet a wide range of industrial packing requirements. According to this folder coil and spiral packings are most economical for maintenance purposes because rings for many different stuffing boxes can be cut from the same coil and spiral. A table lists the best recommendations for a number of conditions and applications.

Circle No. 82

INDUSTRIAL RUBBER PRODUCTS . . . made by Quaker Rubber Corporation, Division of H. K. Porter Company, Inc., are illustrated in a new 58-page general catalog. The catalog is divided into sections for quick reference to a product. There are sections on packings, hose, belting and molded rubber products. Each product described is illustrated in a cut-away section. Performance data, specifications, working pressures, weights and all technical information is given. There is also complete information on different types of hose couplings.

Circle No. 83

HOMOGENEOUS "V" RINGS . . . recommended for hydraulic and pneumatic applications for pressures not in excess of 5000 psi are described in an 8 page bulletin released by Raybestos-Manhattan, Inc. These "V" rings made from two types of synthetic rubber are low in friction and low swelling. Complete information is given on sizes available for each diameter of rod or ram. A diagram shows the method of determining the number of rings required for a flat installation. Standard sizes for homogeneous "V" packing rings are given. Also information is given on the characteristics and features.

Circle No. 84

SYNTHETIC PACKINGS . . . made of Kelon, a new fluoroplastic material that provides many important advantages in applications of adverse chemical, electrical and physical environments are discussed in a 4 page two-color catalog offered by W. S. Shamban & Co. The company's modern facilities are also described.

Circle No. 85

SILICONE PRODUCTS REFERENCE GUIDE . . . published by Dow Corning Corporation will help give engineers a maximum amount of information on silicones in limited space. The 1955 guide lists some 23 new products besides the 100 odd mentioned in previous issues. Still retained is the "division by application" method of listing individual products, helping engineers to locate a product by what it does rather than what it is. The application index has been increased from 17 to 21 classifications. The guide contains many tables, graphs and photos.

Circle No. 86

O-RING . . . for aircraft hydraulic service, with a temperature range of minus 65 degrees to plus 400 degrees Fahrenheit has been developed by Parker Appliance Company. This new rubber material meets Military specifications MIL-P-5516A and MIL-P-18017. A spec sheet is available.

Circle No. 87

LATTICE BRAID PACKING . . . for rods and shafts, are described in an 8 page folder issued by The Garlock Packing Company. Just how this packing is made, is shown with illustrations. In these packings the "through and through" braiding makes each strand flexible, so there is no stress when rings are formed. Features and general recommendations for various types of service are included. Available in sizes from ¼ in to 1 in.

Circle No. 88

PISTON ROD BOOTS . . . can be fabricated from two or more weights of materials to meet specified operating conditions in the protecting of air and hydraulic cylinders. Bulletin SPC-1, released by A & A Mfg. Co. explains that the parts are fabricated from a neoprene-base material, which is impervious to oil, grease and water and withstands temperature extremes –60 F to 220 F without cracking.

Circle No. 89

SYNTHETIC RUBBER "O" RINGS . . . Bulletin OB-1152, prepared by United States Gasket Co. completely describes the company's line of "O" rings and back-up rings. Illustrations show the operation of "O" rings with and without back-up rings at increasing pressures. Information is given on how to order the "O" rings and back-up rings. All standard sizes are listed. Included also are the nominal and actual dimensions.

Circle No. 90

Pumps

HYDRAULIC GEAR PUMP . . . A data sheet, released by Pesco Products Div., Borg-Warner Corp., describes this high pressure positive displacement pump. Capacity for pressures of 2000 psi at 2400 rpm is 11 gpm. An outline drawing showing dimensions may be used for installations. Engineering charts are included showing capacity vs pump speed, hp vs pump speed, and volumetric efficiency vs pump speed.

Circle No. 91

AIRCRAFT PUMPS . . . the story of their manufacture is illustrated in an attractive 20 page booklet entitled "The Lear-Romec Story". It describes and pictures the company's engineering and production facilities and its modern test equipment and scientific methods which insure the excellence of product. Two pages show the aircraft to which the company supplies their manufacture.

Circle No. 92

POSITIVE DISPLACEMENT PUMP . . . of new design, introduces a controlled floating vane. Circon Pump Company prepared a specification sheet outlining the features of this pump, in which the floating vanes can be controlled both radially and laterally.

Circle No. 93

PLUNGER PUMPS . . . A new bulletin W-414-B45 on vertical triplex, single action plunger pumps is now available from Worthington Corp. Graphically illustrated by photos, charts, and line drawings, the bulletin contains information about features, applications, ratings, dimensions and specifications. Interchangeable plunger sizes, individual valve covers and flanged suction and discharge openings, stuffing box drains and automatic oiling system are some of the features discussed.

Circle No. 94

HYDRAULIC HAND PUMP . . . for easy and efficient power application to hydraulic systems is detailed in a new 4 page bulletin. Published by Dowty Hydraulic Units Limited. The bulletin shows dimensional drawings, operational data and a sectional view of the unit. Literature states that with alternative connections and pressures variable from 500 to 4,000 psi, the pump can be adapted to suit a wide range of individual requirements.

Circle No. 95

FLUID POWER EQUIPMENT . . . manufactured by The Oilgear Company is detailed and illustrated in a new 12-page bulletin, 10051-D. Literature shows pumps, motors, transmissions, cylinders, valves and accessories. Also featured are a new electric-hydraulic servo control system for pumps and transmissions up to 150 hp, a new line of Oilgearducers for constant torque drives.

Circle No. 96

HYDRAULIC POWER UNIT . . . previously offered in pressure ranges from 250 to 1000 psi is now available in higher pressure ranges, from 1200 to 2000 psi. Manufactured by Logansport Machine Company, Inc., they describe the engineering changes of the unit, Model 6031, in a new catalog which shows complete data.

Circle No. 97

CENTRIFUGAL PUMPS . . . in ranges from ⅛ to ¾ hp, from 6 to 65 psi and handle up to 70 gpm are described in a 12 page catalog prepared by Eastern Industries, Inc. This easy to read catalog offers helpful engineering data, specifications on all models, performance diagrams, dimensional drawings, instructions on stuffing boxes and mounting diagrams.

Circle No. 98

HYDRAULIC POWER UNITS . . . groups hydraulic equipment such as reservoir, motor, pump and control valves, into a single unit to simplify and improve the overall design of a machine. Catalog C-102, issued by Hydraulic Power Equipment Co. describes standard power units, which includes a small series, medium series and heavy duty units. Custom designed units are also included. Outline drawings and tables show tank dimensions, capacity in gallons, gpm, and motor hp.

Circle No. 99

HYDRAULIC COMPONENTS . . . motors, gear-type pumps, valves, cylinders, valve and pump combinations for up to 1000 psi working pressure are presented in a catalog available from Wisconsin Hydraulics, Inc. The motors and pumps in a number of mounting variations are available in sizes ranging from 8 to 22 gpm. Large diameter single and double acting cylinders, in sizes from 5 to 8 inch diameters, are shown together with operating pressures and dimensions in convenient chart form.

Circle No. 100

DOUBLE PUMPS WITH VALVE PANELS . . . are integral units designed to meet demands for fluid power at 2000 psi for the operation of circuits calling for a substantial variation in pump volume as during "close and hold" or "traverse and feed" cycles. Bulletin No. DP-308, released by Dudco Division, The New York Air Brake Company, describes the design and features. Unit consists of two standard 2000 psi pumping cartridge assemblies within a single compact housing. Valve panels mount directly on the discharge ports of the double pumps. Fluid power can be supplied either to two separate systems or to a single two pressure circuit, controlled automatically.

Circle No. 101

GEAR TYPE PUMPS . . . which are oil hydraulic and pressure balanced for heavy duty machine tools are described in Bulletin No. 142 issued by Hydreco Division, The New York Air Brake Co. The series H pumps are designed for heavy duty machine tools, materials handling and earth moving equipment. A chart gives performance details on all four pumps, cutaway drawings show construction details.

Circle No. 102

HYDRAULIC MACHINERY AND EQUIPMENT . . . This 28-page, file size booklet, issued by The Hydraulic Association contains a check list of the products of the fourteen member firms. Many of these firms represent over a century of experience in the development of hydraulic equipment. Both components and typical machines, presses and equipment to which hydraulic systems are applied, are listed. The Hydraulic Association of Great Britain is a group of leading British manufacturers in the hydraulic equipment field.

Circle No. 103

GEAR TYPE HYDRAULIC PUMP . . . The unit employs a patented pressure balancing system. For pressure deliveries up to 2000 psi, the range includes four sizes of pumps. A chart shows delivery (gpm) of each model pump both clockwise and counter-clockwise at 1500 rpm. A cross section view shows construction and arrangement of parts. Bulletin D.A.2/1 available from Dowty Auto Units, Ltd.

Circle No. 104

PUMPS, VALVES . . . and complete power packages manufactured by Simplex Engineering Co., are the subject of a new bulletin G. The pumps, of the LA Series, are fixed displacement radial piston pumps built on an improved design which enables them to generate pressures as high as 10,000 psi without loss of mechanical efficiency. The pump is well illustrated showing all construction parts and its principle of operation. Safety relief valves, high pressure 4-way valve, high pressure check valve and pilot operated check valve are also described, sizes and pressure ranges tabulated. Power packages shown in this brochure are suitable for a wide range of hydraulic power requirements.

Circle No. 105

Servos

REMOTE CONTROLS . . . for controlling hydraulic valves, winches, charging cranes, slitting machines and other remote control uses are shown in a bulletin available from Trimount Instrument Company, Crown Control Division. Graphs and specification point out some improvements made on the MAT type. Also shown in the bulletin is complete data on the MAR type control which is a gravity feed unit.

Circle No. 106

HYDRAULIC SERVO ACTUATOR . . . offers control system engineers a packaged, linear actuator with good performance. Technical bulletin No. 116-A prepared by Pegasus Laboratories, completely describes the operation and characteristics of the unit. Many diagrams such as typical test circuit block diagram, actuator phase lag, actuator transfer function, and differential current output rate vs input current are included. A hydraulic servo transmission system designed to provide remote position control for test facilities, remote manipulation, process control is also included together with installation drawings.

Circle No. 107

HYDRAULIC TRACER . . . for general machine tool applications is explained and illustrated in a folder released by True-Trace Corp. Model a-3D is a precision stylus operated multiple hydraulic servo valve which controls the flow of oil to and from each end of three

hydraulic cylinders, two of which are mounted horizontally with piston rods at 90 degrees to each other, the third of which is mounted perpendicular to the plane of the other two cylinders. Design, operation and special features of the unit are fully described.

Circle No. 108

System Plumbing

PRESSURE PLUGS . . . with fully formed threads for positive sealing are described in a new catalog. Prepared by Standard Pressed Steel Co., the 32 page brochure details the company's line of socket head screws, self-locking set screws and other precision threaded fasteners. The catalog shows photographs of all products listed, applications are indicated in line drawings and cut away drawings emphasize special features. An easy-to-read table details dimensions of each product and diagrams keyed to the specification tables simplify the measurement references.

Circle No. 109

PLASTIC CAPS AND PLUGS . . . for threads, pipe and tubing ends, are used as shipping protectors and seals against dust and moisture. A 12 page booklet has been released by CaPlugs, Division of Protective Closures Co., Inc. Tables are included which show all dimensions for the various types. Other products included are caps for electrical connectors, threaded plugs for aircraft and hydraulic tube fittings, flange protector caps and sleeve caps for tubing.

Circle No. 110

AIRCRAFT HOSE AND HOSE ASSEMBLIES . . . for use in oil, hydraulic and fuel systems are described in a 16 page catalog published by Resistoflex Corporation. Also featured are high temperature, extra light weight, chemically inert, corrosion-proof hose and assemblies for aircraft and special industrial use. The catalog gives sizes, operating data, construction features, servicing information and a table of standard fittings.

Circle No. 111

SELF-SEALING HYDRAULIC COUPLERS . . . for use on any hydraulic system regardless of high pressure, are illustrated in a 4-page bulletin. These couplers, manufactured by Pioneer Hydraulics, Inc., are of the "Quick" and "Break-Away" types, feature swivel action. Couplers maintain full free flow of fluid with minimum turbulence; the ball checks are held exactly in the center of the line of the coupled position. Sizes and applications for each type coupler are given and their prices listed.

Circle No. 112

PROTECTIVE CLOSURES . . . for use on hydraulic lines and assemblies when handling, shipping and storing is described in a new plastic bound 14 page catalog containing specifications and prices. The catalog may be obtained from Tubing Seal Cap, Inc.

Circle No. 113

2 PIECE REUSABLE COUPLINGS . . . for one wire braid cotton cover hydraulic hose. Particularly helpful for on-the-job replacements and for emergency repairs, as no special tools are needed. Hose does not have to be stripped, just inserted into the coupling body. Four operations are required to make a proper installation. Bulletin No. 105, released by Eastman Manufacturing Company, shows how this is done, step by step. The various coupling catalog numbers are listed in a chart which gives thread sizes, hose catalog number, id and od of hose, minimum bending radii, maximum psi and maximum burst pressure.

Circle No. 114

RE-USABLE COUPLINGS . . . for medium-high and high pressure service, which feature a double-wedge grip, are described in Bulletin H-100 offered by Joy Manufacturing Company. The double wedge grip permits assembly on rubber covered hose without skiving. Through use of a special slotted bushing it is possible to retighten the coupling on the hose without disassembly when and if it comes loose through vibration or flexing No special tools are required for assembling couplings on hose.

Circle No. 115

TUBE FITTINGS . . . A comprehensive 76 page catalog, 4300, published by The Parker Appliance Company, lists steel, brass, stainless steel, aluminum leakproof tube fittings and tube fabricating equipment. Beautifully illustrated, the catalog is divided into several parts, presenting 3-piece flare fittings, flareless fittings, pipe fittings, tube cutters and others. Each section is fully illustrated, giving complete specifications and engineering data of components described. The catalog includes tube bending and flaring instructions, tubing selection data and recommendations for wall thickness of tubing for various pressures and types of service.

Circle No. 116

BALL BEARING SWIVEL FITTINGS . . . which range in size from ⅜ to 1 inch and from working pressures of 6,000 psi at 225 degrees F to 1,250 psi at 750 degrees F, are outlined in a bulletin issued by Emsco Manufacturing Company. Covering the HP and HT types, the literature describes method of construction and application of these fittings. Illustrated with many sectional drawings, it gives complete dimensions, specifications, weights and engineering data.

Circle No. 117

TUBE WORKING TOOLS . . . A new pocket size catalog providing condensed listings of the complete line of tube working tools of The Imperial Brass Mfg. Co. is available. Included in booklet No. 3030 are all of the tools for cutting, flaring, bending, swedging, reaming and pinch-off of tubing. Test plugs and tools for refacing flared fittings are included. Tools for copper, aluminum, steel and stainless steel tubing are also shown. Flaring tools are listed in both 45 and 37 degree types.

Circle No. 118

SELF-SEALING COUPLINGS . . . for hydraulic pressure lines of up to 3000 psi are detailed in an eight page catalog issued by Dowty Hydraulic Units, Ltd. Graphs produced from figures obtained under actual working conditions show that these couplings have a minimum pressure loss. Sizes and installation data, and sectional drawings are given.

Circle No. 119

HOSE COUPLINGS . . . designed for one-hand operation are described in a new brochure prepared by Breco Manufacturing Co., Inc., Division of Perfecting Service Company. The bulletin, 54-1R, shows a variety of styles and types of couplings featuring quick connect-disconnect operation without turning or twisting to lock, just push in. Automatically locks, making high pressure leakproof connection. Integral check valve automatically shuts off line or hose pressure when disconnected, prevents danger of backlash or whipping. Couplings can be used for applications up to 10,000 psi.

Circle No. 120

PUSH TYPE QUICK COUPLERS . . . which employ the one hand connect and disconnect principle are covered in True Flate's, Inc., No. 4 catalog. Available in two body sizes with pipe threads from ⅛ to ½ inch, the coupler's working parts are of case hardened steel. This catalog also contains information on sleeve type ball locking couplers engineered to provide a maximum flow of air with minimum line pressure drop. All units are illustrated, diameter and thread sizes listed.

Circle No. 121

Valves

HYDRAULIC VALVES . . . which are solenoid operated and sub-plate mounted are described in an 8 page catalog No. 260, offered by Rivett Lathe & Grinder Inc. Featured are J.I.C. diagrams showing flow operations under all types of action for each one of the fourteen piston designs. Also highlighted are cut-a-way illustrations showing shock resistant spool design.

Circle No. 122

SOLENOID VALVES . . . New bulletin A-3 describes and illustrates additions to the line of general service solenoid valves manufactured by J. D. Gould Co. Included in the models are normally closed or normally open types in three sizes, 1" 1-¼" and 1-½". Designed to eliminate hammer and shock in automatic or remote control of liquid flow, air or gas.

Circle No. 123

FLUID CONTROLS . . . Catalog 2A, containing 62 pages, has recently been released by Hoke, Inc., covering the products which they manufacture. The controls presented are, needle valves, toggle valves, packless valves, needle valve controls, pressure regulators, accessories and fittings, stainless steel cylinders, flo-gages and oxy-gas torches. Each of these products is handled in the catalog as a separate section. Very complete information is contained in the catalog, answering questions on thread sizes, connection sizes, styles, materials, specifications and applications.

Circle No. 124

HYDRAULIC CONTROL VALVES . . . Eight new hydraulic control valves with ball detent for position locking are discussed in catalog sheets, a section of Catalog No. 200, issued by Logansport Machine Company. Included are six 3-position, 4-way valves and two 2-position 4 and 3-way valves.

Circle No. 125

AIR RELEASE VALVES . . . manufactured by The V. D. Anderson Co., are described in condensed bulletin No. 654. The data sheet gives complete information on three different styles of air release valves used for venting air from liquid lines and tanks under pressure. Also included is a capacity table showing the cubic feet of free air handled by various valves at different operating pressures.

Circle No. 126

HYDRAULIC VALVES . . . for high pressure, large press applications requiring accumulator station control are featured in literature issued by Lombard Corporation. All valve bodies are of forged carbon steel for the standard valves for normal service. The catalog gives complete engineering data, diagram drawings and sizes of throttle and shut-off valves, filling valves and control valves. Special valves and accumulator controls are also detailed.

Circle No. 127

SAFETY AND RELIEF VALVES . . . Kunkle Valve Company completely describes and catalogs the various units available in catalog 53. The 52 page booklet is fully illustrated. All information pertinent to the product is included. Cross section views show construction of the valves and arrangement of component parts.

Circle No. 128

FLOW REGULATORS . . . The combination by-pass and restrictor type flow regulator is used to maintain a constant flow when pump output varies or is greater than required for part or all of the system. They can be used in series to divide the pump output into two or more regulated flows and by-pass the excess. Available in sizes ¼, ⅜ and ½ in pipe. Sheets No. 3.40, 3.41a and 3.42, released by Fluid Controls, Inc., give complete dimensional and application data.

Circle No. 129

HYDRAULIC RELIEF VALVES . . . By-pass, piston type, oil-relief valves for use with oil hydraulic pumps where specific pressure must be maintained. The Fulflo Specialties Co. Inc., has released a 4 page bulletin in color describing these valves. The models available are equipped with one of five different springs, for pressure selections from 0 to 500 psi. Pipe sizes are ¼ in to 2 in. Cross-section views show construction of the valve.

Circle No. 130

DIRECTIONAL CONTROL VALVES . . . built for pneumatic and hydraulic applications are illustrated in Ledeen Manufacturing Company's 16 page catalog. Described are hand, foot, power and solenoid operated valves. Dimensions and weights, application diagrams, circuit diagrams are clearly shown for each type of valve. All have rotating disc construction, chrome plated surface in body, integral disc and stem. The bulletin includes a parts and accessory list.

Circle No. 131

CONTROL VALVES . . . for pneumatic or hydraulic application are described in a 52 page catalog, released by Marotta Valve Corp. Included in the catalog are valves for aircraft, guided missiles, automotive and industrial uses. Book is divided into sections on magnetic, check, regulating and special valves. Complete line is included, with large detailed illustrations of each valve, applications, specifications, installation drawings and flow curves.

Circle No. 132

DIRECTIONAL AND FUNCTIONAL VALVES . . . for oil hydraulic service of 3000 psi are completely described in catalog No. 841, made available by Hydraulic Power Division, The Hydraulic Press Mfg. Co. Many 4-way valves are illustrated and described including cam operated, single solenoid, integral pilot, double solenoid, pilot operated, air pilot operated, 2-way valves, cam operated, single solenoid and pilot operated, rotary pilot valves, relief, sequence and pressure reducing valves. Many more types are included. All are well illustrated. Installation dimensions are given for the sizes listed. A section of the catalog is devoted to subplates, both with straight and side outlets.

Circle No. 133

HYDRAULIC PRESSURE REDUCING VALVES . . . designed for aircraft and industrial uses, are described in a bulletin offered by GAR Precision Parts, Inc. Available in ¼ and ⅜ in od ports, they can be obtained from stock in either 1500 or 3000 psi. These lightweight valves are free of "chatter" and "whistle" at reduced pressures.

Circle No. 134

HYDRAULIC AND PNEUMATIC CONTROLS . . . are presented in catalog 4G available from Barksdale Valves. Manual valves, solenoid valves, solenoid pilot controlled valves and pressure switches are incuded in the booklet. Many models of the above types are also illustrated. The 36 page catalog is in color. The valving principle is explained. Each of the valves presented are illustrated by cross-section views and flow patterns. Valve characteristics are shown together with port size, minimum flow passage, rated flow at 20 fps velocity. The solenoid valve data includes port size and electrical ratings. A pressure switch selection chart guides step by step the selection of the proper switch. Operating characteristics are shown for the pressure switches.

Circle No. 135

FLOW CONTROL VALVES . . . and direct operating pressure controls are described in a new 4 page, three color catalog, released by The Denison Engineering Company. The flow control valve may be quickly reset for more than one application without making changes in spools. It has an adjustable orifice principle which provides a means of adjusting the spool position.

Circle No. 136

SELECTOR VALVES . . . for 2-way 3-way and 4-way usage are described in bulletin No. 754, available from Republic Manufacturing Co. Supplied in six sizes from ⅛ in to 1 in pipe or tube, these valves require no lubricant and are suitable for temperatures from –65 F to 250 F. Working pressure of 100 psi is recommended for air, oil or water. The body is available in either aluminum or stainless steel. An illustration and adequate description is included for each type.

Circle No. 137

AUTOMATIC CONTROLS . . . A folder on automatic controls that can be adapted to manually controlled hydraulic compression presses, batch process machinery or where cyclical operation is required, is available from the Seely Instrument Co., Inc. It describes the applications for timers, temperature and pressure controls and air diaphragm motor valves, that can be arranged singly or in any combination to offer semi or fully automatic operation of present machinery. This folder will prove of value to those interested in tire and tube molding, molding of plastics, phonograph record pressing, metal extrusion and similar industries.

Circle No. 138

HYDRAULIC CONTROL VALVES . . . Pantex Manufacturing Corporation has released new bulletins on 100-5000 psi valves. The subject of bulletin AD is relief valves (Cartridge type unit) 350-5000 psi; bulletin 25, ¼ in directly operated 4-way valves, solenoid controlled, 100-5000 psi; bulletin 55, ¾ in pilot operated 4-way valves, solenoid controlled, 100-5000 psi; bulletin 57, ¾ in pilot operated 4-way valves, remotely controlled, 100-5000 psi. Installation dimensions are shown for each of the sizes available. Complete dimensional information is given on the installation drawings. Similar information is given for both solenoid and remote controlled pilot operated valves.

Circle No. 139

SOLENOID VALVES . . . for oil and air operation are designed for pressures to 5000 psi at 150 F and 2500 psi at 450 F. Bulletin HP201, released by Atkomatic Valve Company, Inc., illustrates features of the high pressure pilot operated and direct life solenoid valves, with diagrams of electrical circuits used for normally open, and normally closed operations. A cross sectional drawing shows the construction of the valve. A table shows for each pipe size, the orifice, psi, temperature and material.

Circle No. 140

VALVES AND FITTINGS . . . manufactured by the Kohler Co. are described and illustrated in a new 20 page catalog. It features hydraulic check valve, hydraulic relief valve, hydraulic restrictor valve, pneumatic check valve, swing check valve, needle valve and plug valve. All the controls are shown in diagram drawings, sizes and engineering data is tabulated.

Circle No. 141

AIR AND HYDRAULIC VALVES . . . Several bulletins have been issued by Beckett-Harcum Company, covering these products. Bulletin No. 101 and 102 presents the air valves and bulletin No. 103 and 104, the hydraulic valves. Each of the bulletins give features and specifications. Directional flow and a flow chart are included. Solenoid current characteristics, solenoid specifications, parts lists and a cross-sectional views of the valves are also included.

Circle No. 142

AIR VALVES . . . are the subject of a comprehensive 44 page catalog, No. 51, published by Ross Operating Valve Company. Among the many standard types illustrated and described are hand, foot, cam and solenoid valves, master valves for remote control operations, and small valves for pilot control with hand, foot, cam or solenoid operation. Also shown are speed control and other special purpose valves. Sectional drawings detail construction features of each type valve. Several pages are devoted to general reference data and installation diagrams.

Circle No. 143

FLUID POWER DEVICES . . . including cylinders, valves and packaged units are briefly described and illustrated in a 4-page bulletin published by Modernair Corporation. All the units featured in this literature are fully described in individual brochures available upon request. Highlights of the company's facilities are included. One page pictures and describes typical applications of components made by Modernair.

Circle No. 144

SOLENOID PILOT OPERATED VALVE . . . An air-control valve built to meet J.I.C. standards is described in Valvair bulletin SKJ-54. The design is simple, having only two moving parts; a single spool type stem in the main valve body and the plunger in the pilot. Recommended pressures are from 35 to 200 psi for air and low pressure hydraulics. Available in 2-way, 3-way, 4-way and 4-way-5-port models with either fast mounting or sub-base manifold mounting in the 3-way and 4-way valves.

Circle No. 145

SOLENOID VALVES . . . Pilot pressure equal to operating line pressure is employed to shift the valve spool, thus permitting use of a small, continuous duty solenoid directional valve and eliminating need for large expensive, directly connected solenoid actuators. The valve may be used as a three-way, two three-way, two two-way combinations at pressures not exceeding 200 psi. Cross-section views aid in showing construction of the valve and its operation. Also line drawings show all dimensions necessary for installation purposes. Ask for SEC 11-A-24 released by Modernair Corp.

Circle No. 146

HYDRAULIC CONTROL VALVES . . . Dimensional data and features of directional valves for mobile equipment applications, covering 1, 2, 3, and 4 spool models from 8-35 gpm capacity, are provided in a new 10 page catalog file published by Industrial Hydraulics Division, The Parker Appliance Company.

Circle No. 147

AIR CONTROL VALVES . . . A 66 page catalog completely describing the line of Airmatic Valve, Inc., is now available. The catalog gives all pertinent information for 2-way, 3-way and 4-way valves and for the following types: cam, flow control, foot, hand, interlock, pilot, pressure regulator, quick exhaust, sequence, solenoid, and time delay. Also presented are air and hydraulic cylinders. Information on size, pressures, features, applications, parts lists, mounting dimensions and cross-sectional views are given for each valve presented. Similar data is given for the cylinders.

Circle No. 148

FLOW CONTROL VALVES . . . A new 4 page two color bulletin 53-35, describing these valves for machine tool and welding machine oil hydraulic systems, may be obtained from Vickers, Inc. Flow control circuits, performance curves, installation data and complete specification tables are given. Gasket mounted valves in a series of models for ¼, ⅜, ¾ and 1¼ in standard pipe sizes are presented. One-quarter in size valves with integral check valve for reverse free flow are discussed.

Circle No. 149

BLEEDER VALVE . . . which is semi-automatic and makes bleeding of air from hydraulic systems a fast fingertip operation is described in a bulletin released by Greer Hydraulics, Inc. The ease of operation is illustrated. Cross-section views show the construction of the valve. All dimmensions and part nomenclature are shown on drawings. Other uses including the dumping of air pressure in pneumatic systems are discussed. How it works, features, specifications are covered. Valve will withstand pressures up to 20,000 psi.

Circle No. 150

Circle 21 on Reader Service Card

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KOHLER *Precision Controls*

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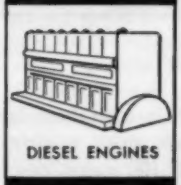
DIESEL ENGINES

LIFT TRUCKS

AUTOMOTIVE

TRACTORS

FOR POSITIVE ACTION

Kohler hydraulic check valves are products of an organization experienced in meeting requirements of manufacturers in aircraft, industrial and automotive fields. All are precision lapped, with positive checking action that prevents leakage throughout long service.

Kohler Co. maintains facilities for forging, casting, machining, anodizing, in one plant—and is a leading supplier of precision controls for hydraulic, fuel, pneumatic, jet engine and airframe applications. Controls are developed to specification, for volume production.

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Kohler Co. is the only supplier with AN approval for all sizes in the K-1207 check valve from ¼" to 1".

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Kohler Co., Kohler, Wisconsin
Established 1873

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PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS
AIR-COOLED ENGINES • PRECISION CONTROLS

Circle 106 on Reader Service Card

Circle 57 on Reader Service Card

AIR VALVES . . . are the subject of a comprehensive 44 page catalog, No. 51, published by Ross Operating Valve Company. Among the many standard types illustrated and described are hand, foot, cam and solenoid valves, master valves for remote control operations, and small valves for pilot control with hand, foot, cam or solenoid operation. Also shown are speed control and other special purpose valves. Sectional drawings detail construction features of each type valve. Several pages are devoted to general reference data and installation diagrams.

Circle No. 143

FLUID POWER DEVICES . . . including cylinders, valves and packaged units are briefly described and illustrated in a 4-page bulletin published by Modernair Corporation. All the units featured in this literature are fully described in individual brochures available upon request. Highlights of the company's facilities are included. One page pictures and describes typical applications of components made by Modernair.

Circle No. 144

SOLENOID PILOT OPERATED VALVE . . . An air-control valve built to meet J.I.C. standards is described in Valvair bulletin SKJ-54. The design is simple, having only two moving parts; a single spool type stem in the main valve body and the plunger in the pilot. Recommended pressures are from 35 to 200 psi for air and low pressure hydraulics. Available in 2-way, 3-way, 4-way and 4-way-5-port models with either fast mounting or sub-base manifold mounting in the 3-way and 4-way valves.

Circle No. 145

SOLENOID VALVES . . . Pilot pressure equal to operating line pressure is employed to shift the valve spool, thus permitting use of a small, continuous duty solenoid directional valve and eliminating need for large expensive, directly connected solenoid actuators. The valve may be used as a three-way, two three-way, two two-way combinations at pressures not exceeding 200 psi. Cross-section views aid in showing construction of the valve and its operation. Also line drawings show all dimensions necessary for installation purposes. Ask for SEC 11-A-24 released by Modernair Corp.

Circle No. 146

HYDRAULIC CONTROL VALVES . . . Dimensional data and features of directional valves for mobile equipment applications, covering 1, 2, 3, and 4 spool models from 8-35 gpm capacity, are provided in a new 10 page catalog file published by Industrial Hydraulics Division, The Parker Appliance Company.

Circle No. 147

AIR CONTROL VALVES . . . A 66 page catalog completely describing the line of Airmatic Valve, Inc., is now available. The catalog gives all pertinent information for 2-way, 3-way and 4-way valves and for the following types: cam, flow control, foot, hand, interlock, pilot, pressure regulator, quick exhaust, sequence, solenoid, and time delay. Also presented are air and hydraulic cylinders. Information on size, pressures, features, applications, parts lists, mounting dimensions and cross-sectional views are given for each valve presented. Similar data is given for the cylinders.

Circle No. 148

FLOW CONTROL VALVES . . . A new 4 page two color bulletin 53-35, describing these valves for machine tool and welding machine oil hydraulic systems, may be obtained from Vickers, Inc. Flow control circuits, performance curves, installation data and complete specification tables are given. Gasket mounted valves in a series of models for ¼, ⅜, ¾ and 1¼ in standard pipe sizes are presented. One-quarter in size valves with integral check valve for reverse free flow are discussed.

Circle No. 149

BLEEDER VALVE . . . which is semi-automatic and makes bleeding of air from hydraulic systems a fast fingertip operation is described in a bulletin released by Greer Hydraulics, Inc. The ease of operation is illustrated. Cross-section views show the construction of the valve. All dimmensions and part nomenclature are shown on drawings. Other uses including the dumping of air pressure in pneumatic systems are covered. How it works, features, specifications are covered. Valve will withstand pressures up to 20,000 psi.

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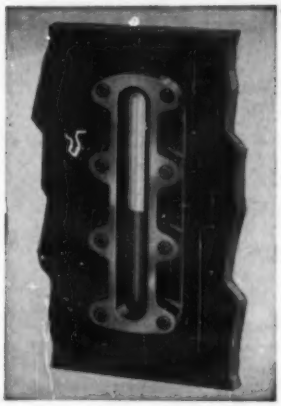

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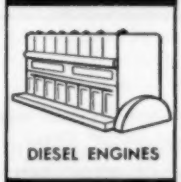
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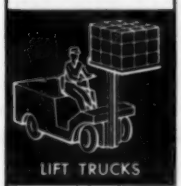
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Kohler Co. maintains facilities for forging, casting, machining, anodizing, in one plant—and is a leading supplier of precision controls for hydraulic, fuel, pneumatic, jet engine and airframe applications. Controls are developed to specification, for volume production.

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Kohler Co., Kohler, Wisconsin
Established 1873

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MECHANICAL ENGINEERS

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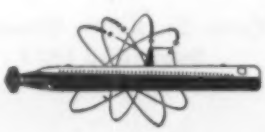

Quite a bit these days, with so many companies getting into the field. While many new firms are now starting to explore the field, Electric Boat Division of General Dynamics Corporation led the way with the building of the first nuclear powered submarines, Nautilus and Sea Wolf.

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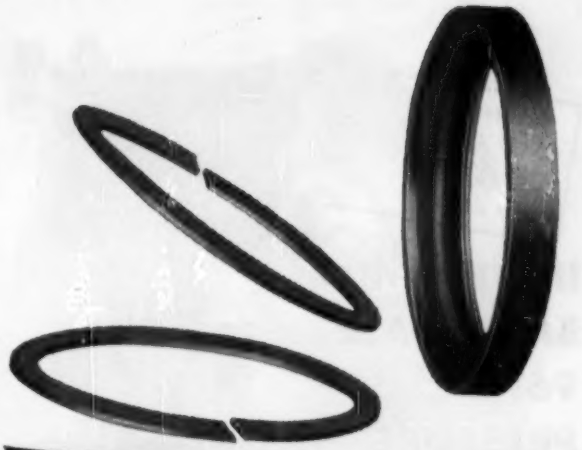

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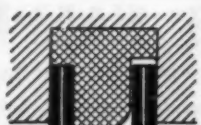

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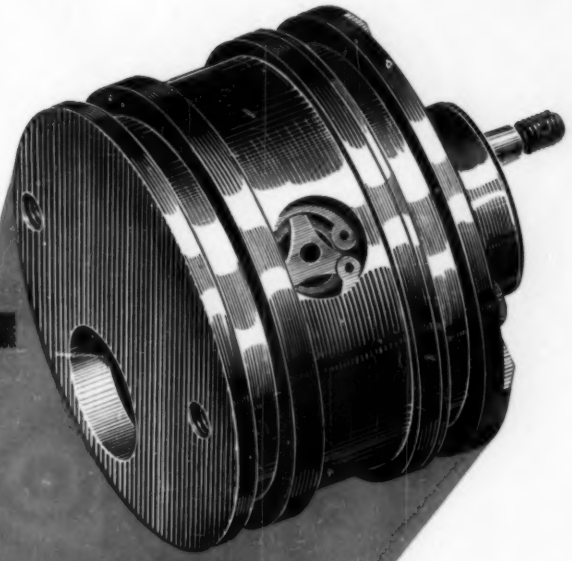
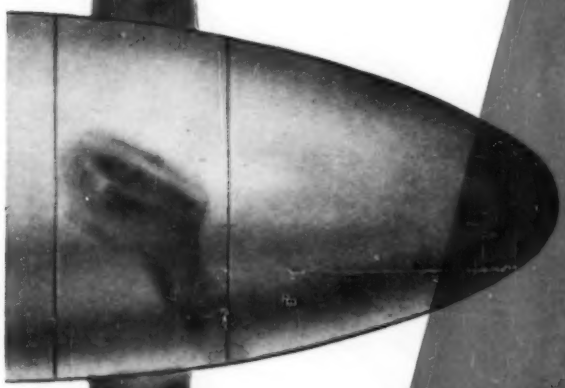


Actual size illustration of Model 811815 Pesco Cartridge Pump showing inlet and outlet ports. Pump delivers over 2 gpm at 5050 RPM and 1050 psi. Low weight is a feature of the unique Cartridge Pumps—this unit weighs only one pound.



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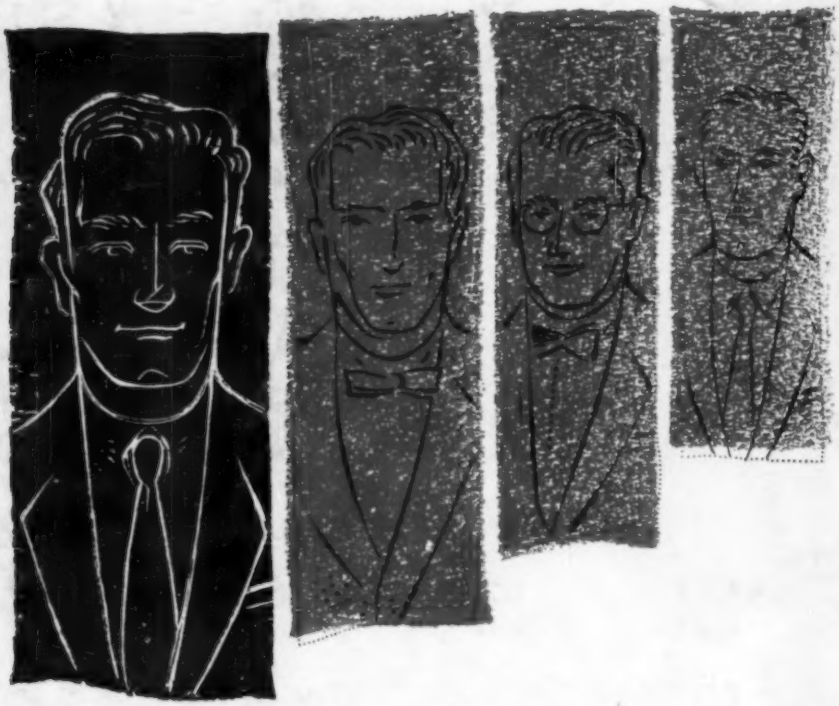

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